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THE PRACTICAL TEACHER

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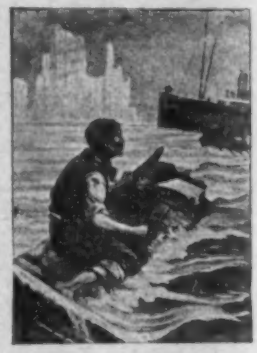

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EDUCATION IN PARLIAMENT—OCTOBER-NOVEMBER.

THE Saturday Review in general tries to live up to its old reputation for satirically skinning alive and metaphorically bludgeoning the statesman, the author, and other folk who live in the public eye. Occasionally, however, it deviates into justice, and even laudation, in its estimates. In a recent article on "The Expert in Parliament," *The Saturday Review* remarked that "no one can have followed the debates on the Education Bill without being struck by the effective participation of Messrs. Gray, Macnamara, and Yoxall. These three gentlemen were all returned upon a particular ticket (to borrow an Americanism), or to represent a specific interest—primary education. They were chosen by their constituents because they had a personal and professional knowledge of an important public question, and they have justified the choice, not only by their speeches, but by the impression which those speeches have made upon the House of Commons." High praise, indeed, from what used to be called the "Saturday Reviler," for the Dauntless Three.

Since the resumption of Parliament this autumn, the efforts of the Three have been again conspicuous. No private member has spoken so often—and, indeed, few so well—in the Education debates as Dr. Macnamara has done. Messrs. Gray and Yoxall have spoken less often, and, if never without cause, never also without effect. Points they have pressed for have been gained; proposals they have deprecated have been withdrawn or defeated. Inch by inch, every amendment which the Conference of the National Union of Teachers, in its now evident wisdom, suggested with regard to the Bill, has been adopted in whole or in part, so far as the series has gone, and Education has indeed been justified of her spokesmen. Very patently this may be seen in what has happened to the original text of Clause 8 of the Bill. Clause 8 contained many points of detail in which the interests of education and the comfort and dignity and freedom of the teachers were involved. I print below the clause as it stood and the clause as it now reads; in those parts of it which were essentially matters of education I print the gains in italic letters.

AS DRAFTED.	AS AMENDED.
1. The local education authority shall maintain and keep efficient all public elementary schools within their area which are necessary, subject, in the case of a school not provided by them, to the following conditions:—	1. The local education authority shall maintain and keep efficient all public elementary schools within their area which are necessary, *and have the control of all expenditure required for that purpose*, other than expenditure for which under this Act provision is to be made by the managers, so long as, in the case of a school not provided by them, the following conditions and provisions are complied with:—
(a) The managers of the school shall carry out any directions of the local education authority as to the secular instruction to be given in the school.	(a) The managers of the school shall carry out any directions of the local education authority as to the secular instruction to be given in the school, *including any directions with respect to the number and educational qualification of teachers to be employed for such instruction, and with respect to the dismissal of any teacher on educational grounds; and if the managers fail to carry out such directions, the local authority shall, in addition to their other powers, have power themselves to carry out the directions in question as if they were the managers.*

(*b*) The local education authority shall have power to inspect the school, and the accounts of the managers shall be subject to audit by that authority.	(*b*) The local education authority shall have power to inspect the school. *Government audit, by the local Government auditor, to be substituted.*
(*c*) The consent of the local education authority shall be required to the appointment of teachers, but that consent shall not be withheld except on educational grounds.	(*c*) The consent of the local education authority shall be required to the appointment of teachers, but that consent shall not be withheld except on educational grounds; *and the consent of the authority shall also be required to the dismissal of a teacher, unless the dismissal be on grounds connected with the giving of religious instruction in the school; provided that assistant teachers and pupil teachers may be appointed without reference to religious creed or denomination.*
(*d*) The managers of the school shall, out of funds provided by them, keep the schoolhouse in good repair, and make such alterations and improvement in the buildings as may be reasonably required by the local education authority.	(*d*) The managers of the school shall provide the schoolhouse free of any charge, except as to the teacher's dwelling, if any, to the local education authority for use as a public elementary school, *also for other educational purposes if the local education authority shall have no other suitable accommodation in provided schools on not more than three days in the week, and shall.....*

To the above must be added the pledge given by the Parliamentary Secretary of the Board of Education, to the effect that next year's Code shall contain a prohibition of making "extraneous tasks" a condition of appointment as teacher in a school. Also the gain (by Dr. Macnamara) that schoolrooms used at night for parochial purposes shall be left in good condition for school purposes next morning, and the textual adoption of the suggestion by Mr. Gray that small local authorities for "secondary education on a penny rate" need not adorn themselves with the panoply of an education committee, are good points to be mentioned. Perhaps the most important of these subsequent emendations arose from Mr. Yoxall's fight against the probability of the appointing of *two* committees, one for elementary, one for other than elementary, education. Mr. Balfour had in the end to yield to the persistence of Mr. Yoxall, and words are to be added to Clause 12 to avert the danger.

Generally speaking, it may be said that day by day the Bill has been made a better instrument for its real function, which is *not* the support of denominational schools, however much that may have been, and may still seem to be, the aim of its promoters. The real function of the Bill is to bring about an enormous and undenominationalising change in the English primary school world. This the champions of denominationalism above everything are beginning to see; already they have revolted from the Government twice. But Mr. Balfour goes calmly on, steering a skilful course upon an even keel. No doubt *he* understands what in the end the Act will do. So do the teachers and the teacher members.

Nothing is more significant of the power of educationists' opinion on this Bill than the part of Clause 12 which says, "Any person shall be disqualified for being a member of an education committee who, by reason of holding an office or place of profit, or having any share or interest in a contract, is disqualified for being a member of the council appointing the committee." So far, of course, the sub-section shuts out all teachers—who are to be paid by the council from the educational funds—from being members of the education committee. But a fight was made on that point by Mr. Gray, among others, and the following was added: "*But no such disqualification shall apply to a person by reason only of his holding office in a school or college aided, founded, or maintained by the council.*" So that teachers are to be the only paid servants of a local authority for education who may sit on the education committee. Carefully considered, this will be seen to be a remarkable exception; and it is the more remarkable because Sir John Dorrington, representing the County Councils Association, would have had only teachers in "aided" schools eligible—which meant grammar-school secondary teachers only. But the House insisted on making Board and Voluntary teachers eligible as well.

The secondary school teachers have not come off very well in this Bill. All that they have obtained they obtain in common with the primary school teachers, who also get a good deal which the secondary teachers do not—for example, appeal against dismissal. No appeal is put in the Bill on behalf of secondary school teachers, though they need protection badly—the assistant-teachers in particular. But they cannot grumble with any fairness. So long as they hold aloof from the one Teachers' Union which has real Parliamentary influence, and pack themselves into little water-tight compartments of separate insignificant associations, they cannot expect to obtain their rights. Parliament helps those who help themselves.

Another instance of democratic power wielded by the teachers of the democracy is shown in the Welsh clause. The Bill proposed to hand over the management of primary education in Wales and Monmouth to the county governing bodies created under the Welsh Intermediate Education Act for secondary education only. These bodies rather held aloof from elementary schools and their teachers. The latter refused to accept the inclusion of themselves and their schools within the scope of a secondary education body. The Bill had to be altered, and the county governing bodies are to die.

BY MANY HANDS.

IN the midst of all the wrangling over the question of supply and demand in the matter of evening schools, it may be well for extremists of both parties—those who would open an evening school only in response to the clamours of the benighted seeking for light, and those who would offer all kinds of inducements to coax people to join—if they would just cast a glance across the Channel. The evening continuation schools there are apparently besieged. We do not know whether extra police are required to regulate the traffic in the neighbourhood of the schools, but we read in the *Manuel General:* "From the factory, the farm, the office, and the shop people take every evening the road for the school, anxious to learn not merely in order to improve their

Evening Schools across the Channel.

better." Judging from the official report, the method of improving their powers and learning to perform their duties is not unmixed with a certain amount of amusement; for we read: "The school tends more and more to become the house of the people.....It becomes a centre of attraction, where they go to chat, to learn, to study, and *to get a little innocent enjoyment.*" We venture to use the last phrase to translate *se distraire honnêtement*, but should not like to arbitrate on what are the innocent enjoyments that should be provided in the evening continuation schools.

WE sometimes have complaints that the arrangements for cleaning some of our rural schools are not satisfactory, but we do not think that the pupils are often set to do the work. The custom, however, seems to be rather common in France, and we are pleased to see that there is a movement in favour of obliging the authorities to provide the necessary funds for paying a sweeper. Public opinion in this matter is shown by two letters recently published in the *Rappel*. The first records the fact that, on the proposition of the mayor, the municipal council of Villeneuve-le-Roi has just voted the sum necessary for the payment of a woman, who shall be charged with the sweeping of the schoolrooms of the communal schools. The second is from Dr. Archavski, who says: "In nearly all the villages the schools are swept by the pupils, and even the daily cleansing of the closets is done by them. Dust is a very powerful means for the spread of tuberculosis, and it is in this way that children, who are of the age which is most susceptible of tuberculous infection, are often attacked. I believe that it is absolutely urgent to take general measures for the suppression of this cause of infection. It is absolutely necessary to impose on the municipal councils the obligation of having sweepers for the communal schools."

Sweepers Wanted.

This demand is not made at the instance of teachers only, but is a matter of public concern, and we hope that the practice will soon be abolished.

"THE President of the Board of Education has appointed Colonel G. Malcolm Fox, late Inspector of Army Gymnasia, Aldershot, as Inspector of Physical Training under the Board." So runs the paragraph in the daily papers. There is quite a military ring about the announcement. It looks as if the Board of Education means business in this matter of military drill. Thank Heaven, the increased means with which the Education Bill will, they say, provide us will enable us to requisition the necessary supply of wooden swords and pop-guns. Then we oldsters will have to pull ourselves together and shake off this tendency to waddle, or what will the colonel say? As for dear old Miss ——, who keeps the village school over yonder at Boggyhole, single-handed, one cannot think what she will do. With her tender feet, it is hard to picture her showing the big boys and girls how to "form fours" out in the playground, while the little ones are left to jump over the benches inside. But no doubt it is a bright and a noble idea. It will make the children love their country so much, and train a race of heroes far nobler than any of those who have gone before. We salute the gallant colonel. Eyes right!

Attention!

N.U.T. NOTES.

TEACHERS will not readily forget the 28th of October 1902; for on that day, from his place in the House of Commons, England's Prime Minister, during the discussion on Clause 8 of the Education Bill, introduced an amendment which will, in my opinion, go far towards effecting a satisfactory settlement of the Tenure difficulty. The exact words which, on Mr. Balfour's motion, were added to the Bill are:—

The Tenure Problem.

"*The consent of the authority shall also be required to the dismissal of a teacher, unless the dismissal be on grounds connected with the giving of religious instruction in the school.*"

Absolutely the best form of appeal would be an appeal to the law courts. Failing this, the placing of a veto on dismissal in the hands of the local authority is a valuable concession. Frankly, I don't like the reservation, "unless the dismissal be on grounds connected with the giving of religious instruction in the school," for one can readily see that attempts will be made by tyrannical and unjust managers (should these exist after the passing of the Bill) to utilise "religious grounds" in the case of any teachers they may desire to supersede. At all events, we shall be spared, in the future, the flagrant and grotesque cases which have been from time to time exposed in all their nakedness in the columns of *The Schoolmaster*. It may not be generally known that for *one* case which is thus noticed the Tenure Committee deals privately with at least *fifty*, and only the members of the Executive are thoroughly conversant with the extent and magnitude of the Committee's operations. Whilst a feeling of satisfaction will pervade the breasts of all good Unionists, two men—Messrs. Marshall Jackman and T. H. Jones—must be specially proud at the securing of this right of appeal. Mr. Jackman can fairly claim to have inaugurated the Tenure campaign when, some ten years ago, he took up the famous Wimblington case; and his magnificent "Tenure Address" at the York Conference of 1900 will never fade from the memories of those privileged to hear it. Mr. T. H. Jones has been chairman of the Executive's Tenure Committee since its formation. In nearly every county of England has he investigated cases of capricious dismissal, devoting practically all his leisure to this important phase of Union activity. No one would be more delighted than he could he feel his occupation—like Othello's—gone.

CLOSELY connected with this question of reasonable security of tenure is that of compulsory extraneous tasks. In fact, I shall probably be not far wrong when I state that, directly or indirectly, these extraneous duties are responsible for more dismissals than any other circumstance. Dr. Macnamara, M.P. (whose strenuous efforts to make the Bill a *good* Bill are appreciated even by his political opponents), sought to secure the Government's acceptance of this amendment:—

Extraneous Duties.

"Neither shall it be lawful for any body of managers to make it a condition of appointment in the case of any teacher that the said teacher shall undertake to perform, or to abstain from performing, any duties outside the ordinary school hours, or unconnected with the ordinary work of the school."

Mr. Balfour did not seem prepared to recommend the adoption of this amendment, apparently fearing that the proposal would prevent teachers adding to their salaries

by work outside the school. But his sympathies were clearly outlined by these words: "To overburden teachers by throwing upon them duties not connected with teaching would be *clear interference with their efficiency as teachers of secular instruction, and the local authority would have power to intervene.* If a teacher were dismissed for refusing to perform these extraneous duties, he would appeal to the authority, and the local authority would decide the matter." After a discussion, in which M.P.'s generally evinced their anxiety to lighten the teachers' burdens, the new Education Minister, Sir William Anson, undertook to deal satisfactorily with the matter in next year's Code. Whereupon Dr. Macnamara expressed the opinion that the undertaking which had been given by Sir William would be, from his point of view and that of the teachers, "an admirable settlement of the question." Every one will look with much interest in next year's Code for the *method* in which the Government's pledge is fulfilled.

THE announcement, early in November, of the retirement of Sir George William Kekewich, K.C.B., from his important and responsible position at the Board of Education, came as a rude shock to the teachers in the nation's schools. Most people would imagine that, in the pending changes in our educational system, his great ability and vast administrative experience would have stood the Government in good stead. But it has been ordered otherwise. For the present I content myself with a humble expression of gratitude for all that he has been able to accomplish. In the days of his predecessor, to say that the relations between the Education Department and the Union's officials were "strained" is euphemistic in the highest degree. When Sir George took the helm, the conditions in the schools were wretched beyond description. Classification by age and the annual parade flourished. His great common-sense saw at once how bad both were for the school children. Little by little, reforms were introduced into the Day School Code, and Sir George was fortunate in having to work with two such vice-presidents as Sir William Hart-Dyke and Mr. Acland as his official chiefs. Two years ago came the introduction of the "Block Grant," which practically terminated the inane "Payment by Results" *régime*. The very modest Superannuation Scheme owes much to his sympathetic foresight; and small though its benefits are, yet hundreds of aged and worn-out teachers are, as a result of its provisions, experiencing the difference between comparative comfort and absolute penury. Only twice has it been my privilege to meet Sir George Kekewich in the flesh. On each occasion I was impressed by his courtesy, his geniality, and his thorough grip of the questions submitted to him. A more "unofficial" gentleman I never met. Personally, at all events, he was not swathed to the smallest extent in red-tape. The good wishes of fifty thousand grateful teachers will follow him in his retirement, and a tangible evidence of our esteem and regard ought certainly to be forthcoming.

"Sir George's" Retirement.

SIR GEORGE KEKEWICH is succeeded at Whitehall by Mr. R. L. Morant, who is largely an unknown quantity. In connection with Mr. Sadler's "Special Enquiries" Department he has done good work; whilst it is freely rumoured that the Government's Education Bill owes much to his organising skill. A task of stupendous difficulty lies before him; but those in a position to give a reliable opinion are satisfied that he is the man to surmount every obstacle.

The New Secretary.

FROM the new building rules of the Board of Education I extract the following paragraph:—

"No school should ordinarily be built to accommodate more than 1,000 to 1,200 children in three departments. *No single department should accommodate more than 400 children.* A large school in three departments might conveniently be divided in the following proportions: boys, 360; girls, 360; infants, 380. For departments of this size the most suitable plan is that of a central hall with the classrooms grouped round it; as a rule, such a department would probably require seven classrooms," etc. Those of us who have inveighed against the educational iniquity of departments with accommodation for 800, 900, 1,000 (and even more) children rejoice that at last the Board of Education has "found salvation" on this question. *Ce n'est que le premier pas qui coûte!* and the next step must be to secure the division and sub-division, at the earliest convenient opportunity, of such gargantuan establishments as exist in Leicester, Birmingham, and other towns.

A. C.

No more "Barrack Schools."

NOTES FROM THE NORTH.

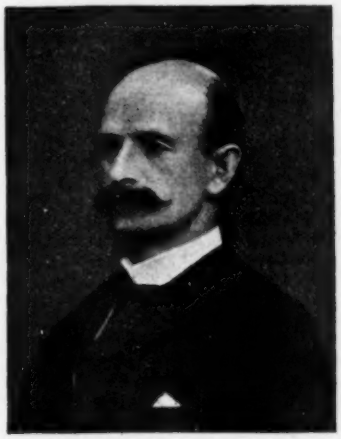
IT is not often that the cause of education is so well represented among the birthday honours as it is this year. The teachers of Scotland will be highly delighted to hear that Mr. John Struthers, principal Assistant-Secretary, Scotch Education Department, has been made a Companion of the Bath. As is pretty well known, Mr. Struthers has passed through nearly all the grades of the profession. He served his apprenticeship as a pupil teacher, and was trained at the Glasgow E.C. Training College, and continued his education at Glasgow and Oxford Universities. Prior to his becoming assistant to Sir Henry Craik, he was an Inspector of Schools in Aberdeen, Edinburgh, and Perthshire Districts. The King has also been pleased to appoint to the Imperial Service Order the following gentlemen connected with Scottish education:—Mr. J. Binnie, Sub-Inspector of Schools for the Renfrewshire District; Mr. J. Macleod, Inspector of Schools for the Moray and Nairn District; Mr. T. Hodgson, First-Class Clerk, Scotch Education Department; and Mr. G. Todd, Assistant-Secretary, Scotch Education Department. This order was recently instituted by His Majesty for members of the civil service of the empire as a recognition of long and meritorious service. Our congratulations to these gentlemen.

Birthday Honours.

THE Education Committee of the United Free Church have unanimously appointed Mr. John Alison, M.A., F.R.S.E., George Watson's College, Edinburgh, as successor to Mr. J. Adams, recently appointed to the Professorship of Education in the London University. Mr. Alison is a native of the Kingdom of Fife, and is the son of the recently-retired headmaster of Gallatown Public School, Kirkcaldy. He was trained as a pupil teacher under the Dysart School Board, and on the completion of his apprenticeship entered Moray House Training College. His excellent

The New Rector of the United Free Church College.

work in that institution is attested by the fact that he took the premier position in the college and the Government examinations. From 1879 to 1884 Mr. Alison attended the Edinburgh University, and specially distinguished himself in Latin, Greek, logic, natural philosophy (medallist), and mathematics. On graduating M.A., in 1884, he was appointed classmaster in Moray House Practising School. This position he held for two years. His next appointment was as second mathematical master in the Edinburgh Academy. After two years' service there he was appointed second mathematical and science master in George Watson's College. Mr. Alison was promoted to the first mastership in 1892. He has taken a very deep interest in professional matters. Twice he was president of the Association of Teachers in the Merchant Company's Schools; he was also president of the Edinburgh Mathematical Society. He carries to the west of Scotland the best wishes of his colleagues and professional brethren in Edinburgh, and will no doubt worthily uphold the reputation of the Glasgow United Free Church Training College.



MR. JOHN ALISON, M.A.

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I HAVE frequently had occasion in these notes to refer to the question of school attendance, and the most recently issued Blue Book does not furnish very pleasant reading on this subject. Of the 767,421 pupils on the registers there is an average attendance of 636,374; so that there are absent every day the schools of Scotland are open no fewer than 131,047 scholars. Taking the counties of Scotland, I find that the highest percentage of attendance is given by Clackmannanshire, 86·8; Buteshire, 86·6; Aberdeenshire, 85·2; and Roxburghshire, 85: while the lowest are—Orkney and Shetland, with 77·1; Caithness-shire, 77·7; Sutherlandshire, 78·5; and Inverness-shire, 79·2. For the sake of comparison, I give the four highest counties in England, as given in Dr. Macnamara's admirable statistics—Westmoreland, 89·3; Bedford, 87·8; Worcester, 86·4; and Berks, 85·4: while the four lowest are—Isle of Ely, 79·7; Lancaster, 80·2; Huntingdon, 80·3; Cornwall (including the Scilly Isles), 80·4. It will thus be seen that Scotland does not come well out of the comparison. Is Scotland resting on her educational oars and allowing the boat to drift? In the general percentages, it is true, England has not yet overtaken Scotland; but it is to be noted that England is steadily improving, while Scotland is gradually going back. Let us take the last five years:—

School Attendance: A Comparison.

	Scotland.	England.
1897.	84·45 per cent.	81·5 per cent.
1898.	84·32 ,,	81·6 ,,
1899.	83·73 ,,	81·8 ,,
1900.	83·14 ,,	82·1 ,,
1901.	82·92 ,,	82·4 ,,

Scotland will require to waken up if she is not to be outpaced in the race.

* * *

APROPOS of the preceding paragraph, the Blue Book, 1901–1902, on referring to the question of attendance, says: "With the passing of the Education (Scotland) Act, 1901, we look forward with confidence to a large increase in the average attendance in the near future." This was the pretty general opinion entertained by teachers and school managers at the beginning of the present year, when the Act came into operation, but there were not a few who thought that into the hands of School Boards had been given too much power in the matter of exemption. That the fears of the latter have been too well founded is apparent from the very large number who are monthly being exempted from attendance at school, though they have not reached fourteen years of age. Of course it will be readily granted that there are many cases of necessitous circumstances, but I question if the passers of the Act contemplated the large and increasing number of exemptions now being made. The Department will require to exercise careful supervision of the schedules. In some of the larger towns the school accommodation is not equal to the strain of increased attendance, and as a result the exemption schedules are looked upon as a loophole to escape from building new schools.

Exemptions from School Attendance.

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ANOTHER phase of the same question came up for discussion at a recent meeting of the Scottish Chamber of Agriculture. One of the members said he objected to the hard-and-fast line drawn at fourteen years of age, and suggested that the Chamber should use its influence with the Scottish Education Department to have that clause altered so as to enable boys of thirteen years of age, after they have secured the Merit Certificate, to get away to labour. If the boys had the three "R's," they should get away to work, if they wanted to, instead of remaining at school till fourteen, and then joining the army of clerks with £10 a year. Incidentally, in the course of his speech, this member gave some indication of the ways of country School Boards, and at the same time a reason for the low average attendance in some rural districts. Those of them who were members of School Boards, he said, knew that they *connived* at letting the children away for the potato-lifting if they made up their attendances. The secretary of the Chamber said that they wanted to raise the question of exemption only in relation to agriculture. There were special provisions applicable to hazardous trades; why should not special facilities be allowed to such an occupation as agriculture? It was agreed to draft a resolution in favour of some relaxation of the age limit in agricultural occupations. The Scottish Education Department, in their efforts to raise the standard of education and to get more regular attendance at our schools, have much opposition to encounter. Where would such relaxations end?

Agriculture and Education.

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IN Scotland we are all watching with eager interest the English Education Bill, knowing full well that Scotland's turn will soon follow. Lord Balfour of Burleigh, in a speech at Greenock last week, gave some indication of the lines along which he would like to legislate. He believes Scottish education to be the very

Scottish Education Bill.

first interest of Scotland, her biggest question, and that on which the whole strength of her national character can best unite, and one on which her very place among the nations depends. If she is to maintain her great traditions, she must be prepared for an advance. The fact that we are free from the disputes that prevail elsewhere should nerve us for that advance. We have no doubt some financial and administrative difficulties in regard to secondary education, and it is possible that the line of least resistance might be to do the work which lies before us piecemeal, and, first of all, to deal with those difficulties. But we must remember Scottish traditions. These have always considered Scottish education as a great whole. We must not divorce the parts; and we must remember that if we are to set our hands to a common task we must face the difficulties all round, and not merely set up arrangements for one branch that may require to be upset when we come to round off our task. So far, Lord Balfour's contention will meet with universal acceptance.

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ELEMENTARY education requires amendments in many particulars. We want to attract the best help. We want to create enlarged interests by enlarging areas. Lord Balfour, however, is far from committing himself to the opinion that it is necessary to do this by the same means that have been thought best in the case of England. We want to establish solidarity between the different parts, and we want to put an end to some legitimate complaints and pressing difficulties. Lord Balfour regards the best means for this end to be *wider areas and more responsible tribunals*. An increased Imperial grant is forthcoming as the result of the English Bill; and now is the time, he maintains, to adapt our arrangements so as to enable us to make the best use of this grant. Secondary education is a vital and important part of the task; but it depends mainly upon being built upon the best foundation of elementary education. He recognises this, and is keen to adjust the financial anomalies. He desires to make the advance a national move; but if a complete advance is not possible, he is not going to refuse to attempt anything. Already in some quarters the speech of Lord Balfour is meeting with opposition, but there is plenty of time to discuss the matter. It is hardly likely that we shall have a Scottish Bill during 1903. Perhaps, as in a former case, he will introduce the Bill in the House of Lords, and allow the matter to be fully discussed by the country. The vague indication which he gave looks all right.

The Means to be Adopted.

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IN the course of a very long letter on the subject of Leaving Certificates, Sir Henry Craik points out that the new Intermediate Certificate was specially instituted to meet the demands of those contemplating a business career when they left school. On the other hand, the Leaving Certificate proper was intended for those who took a complete curriculum at any of our secondary schools, such as may qualify them for proceeding to the university. The candidate who omits practical science in the latter group and takes two languages other than English must include in his group either lower or higher grade Latin. Sir Henry points out that this stipulation does not concern those who are training for a mercantile or technical career, nor does it concern the medical or scientific student; it concerns only those who contemplate making modern languages a special study at the university. He hopes that Circular 340, about which some misapprehension on the point above referred to has arisen, will be the means, in a marked degree, of contributing to the prosperity of modern language study in the universities.

Leaving Certificates.

* * *

IN this connection I note with satisfaction the scheme of the Aberdeen County Council for the encouragement of the further study of modern languages by teachers and students who possess a good working knowledge of literary French or German. Last year the results were so satisfactory that the Technical Instruction Committee of that county have been encouraged to continue and extend its operations. Last year eleven applicants (six head-masters and five lady assistants) were selected for France, and two lady assistants for Germany. The teachers are required to reside abroad for at least six months, and to pursue a course of study arranged in each case with the committee's consent, the aim being the further study of French or German with a view to teaching it. Could not a few more county councils in Scotland imitate this excellent example?

R. G.

Scholarships for the Study of Modern Languages.

ROBERT LAURIE MORANT, C.B.,

Permanent Secretary-Elect to the Board of Education.

Le roi est mort; vive le roi!

Well done, Sir George!—Although Sir George Kekewich is sixty-one years of age, and although there have been rumours for some time of his impending resignation, we have all refused to think of a Board of Education without Sir George as its permanent head. Nevertheless, the inevitable has happened; and before long the kindly man who has been the embodiment of the best traditions of education, will seek the consolations of a well-earned retirement, and will yield place to his vigorous successor, Mr. Robert Laurie Morant, with whom this article has more especially to deal.

The Successor of Sir George.—Mr. Morant, who is to succeed Sir George as Permanent Secretary of the Board of Education, was born on April 7, 1863, and was educated at Winchester and at New College, Oxford, where in 1885 he took a First Class in Honours. By teachers it will be counted to the secretary-elect for righteousness that he has actually been a teacher himself, inasmuch as the first two years after leaving Oxford were spent by Mr. Morant in a private school at East Sheen as assistant master.

With the Siamese.—After these two years, Mr. Morant was specially chosen to proceed to Siam, to organise education there and to personally educate the king's son. How well he accomplished this double purpose is to be read in the history of the development of Siam itself. It is sufficient here to say that Mr. Henry Norman, who studied Siam for a long time as the special correspondent of *The Daily Chronicle*, spoke of Mr. Morant's work in terms of highest praise.

At Toynbee Hall.—Returning to England, Mr. Morant took up his residence at Toynbee Hall, and there he remained for three years; so that he knows something of how the poor live, and is imbued with the desire to make their lives a little less thin and meagre and a little less drab than they unfortunately are. And we, who believe that education is more likely to do this than anything else, may rest assured that the quondam East-ender will be inclined to sympathise with us in this our belief.

Assistant to Mr. Michael Sadler.—It was in 1894 that Mr. Morant returned to England from Siam and took up

his abode at Toynbee Hall. The next year will always be notable, educationally, for the fact that Mr. Morant was chosen to assist Mr. Michael Sadler, who had been appointed director of special inquiries and reports on educational subjects; and some of the finest of the fine reports that are to be found in the earlier of the eleven volumes that so eloquently testify to the industry of Mr. Sadler's department, are from the pen of Mr. Morant, who spent many months in France, Germany, and Switzerland studying the educational systems of those countries, upon which he has written so luminously and with so much acumen. We have often expressed the hope, in the pages of THE PRACTICAL TEACHER, that those who sit in the high places of the Board of Education would give effect to the wise suggestions that stand out boldly from the pages of Mr. Sadler's volumes, and for many of which the country is indebted to Mr. Morant. Who can doubt, now that Mr. Morant himself is to fill one of the highest of these high places, but that our aspiration is to be, in part at least, realised. This in itself is a comfortable and a comforting thought, especially in view of what is to take place in this country after March 26 of next year, when the Education Bill of Mr. Balfour will come into operation.

Private Secretary to Sir John Gorst.—In 1899 Mr. Sadler—much to his regret, we are sure—lost his assistant; and Sir John Gorst gained a notable helper, for in that year Mr. Morant became official private secretary to Sir John. When the Education Bill was being drafted a year ago, Mr. Morant's services were continuously in request, and those who have read the reports to be found over his name in Mr. Sadler's volumes—more especially the one in Vol. III. dealing with education in Switzerland, where the people are almost equally divided between the Protestant and the Roman Catholic religion—will recognise that few men could be found or even wished for better qualified than Mr. Morant to deal with a Bill bound to reopen the religious difficulty in this country.

The Guide to the Feet of the Premier.—Nobody could accuse Mr. Balfour of being an educational expert; yet, as the member in charge of the Education Bill, the Premier has not been found wanting either in knowledge or in device. And there is a very good reason for this. Sitting under the gallery, ready to advise and elucidate, have been seen, throughout the debate, two tireless experts, Mr. Morant and Mr. Thring, and it is these two gentlemen who have been guides to the feet of the Premier, who otherwise would—to quote his own expression—have been a child in these matters.

Why Appointed.—It is to these two facts—namely, that he has been mainly responsible for the drafting and for the defence of the Education Bill—that Mr. Morant probably owes his elevation to the chair of Sir George Kekewich. It certainly conforms to the fitness of things that the burden of administering the Act should fall rather upon the shoulders of Mr. Morant than upon those of Sir George, so that the appointment, from this viewpoint at least, is an ideal one. But this is by no means the only argument that can be put forward in support of Mr. Morant's claim. He is not only well versed in the mysteries of the Bill, but is also mindful of the manifold weaknesses of our so-called system of education. Furthermore, he knows the remedies that must be applied, and he has both the grip and the grit that are needed in the application thereof. To this must be added an amiable disposition that in itself will carry the new secretary far in dealing with recalcitrant councils and sectarian zealots, especially as he possesses the saving grace of resoluteness. In a word, the well-worn Latin saw, *suaviter in modo, sed fortiter in re*, will fit Mr. Morant, if we are not much mistaken in him, to a nicety.

Personalia.—We well remember a meeting of the Association of Headmasters of Organised Science Schools at the rooms of the Society of Arts, John Street, Adelphi, when it was our privilege to make the acquaintance of Mr. Morant. Tall (Mr. Morant must be 6 feet 2 inches in height) and spare, classical in feature, musical in voice, earnest in manner, and sympathetic to a degree, Mr. Sadler's assistant, as he then was, struck us as the very man to tone down asperities and to secure educational efficiency. The matter under discussion was an attempt to get a tangible meaning for that blessed word "delimitation," and we know that the success achieved—and it would have solved the question, if there had been no Cockerton, so far as concerned schools of science and secondary schools of the grammar-school type—was in great part the work of Mr. Morant, who had just written his article on the Higher Primary Schools of France.

An Educational Library.—Most teachers are unaware of the fact that an Education Library, open to readers daily from 10 to 5, is in existence at St. Stephen's House, Cannon Row, Westminster. It was on the occasion of our first visit to this library—for which, we have reason to believe, Mr. Morant is as much responsible as anybody—that we again came into contact with the secretary-elect; and here again we had experience of his urbanity and enthusiasm, so that we are well content that the first steps of the Education Act should be taken under the guidance and with the assistance of so good and true an educationist.

What Mr. Morant has said.—It would be very interesting, did space permit, to make an exhaustive analysis of what Mr. Morant has said—destructive and constructive—with respect to English education. That he has given it hard knocks goes without saying. Every honest and intelligent man is bound to do that. That he has definite and enlightened ideas as to what should replace our chaos—to use his own word—will be readily believed. But space will permit of but a few lines in this connection, so for more we must commend the curious reader to the first three or four of the volumes of reports.

Not too much to hope.—"Surely it is not too much to hope that England may yet learn to value and to create for herself a true and complete organisation of her schools, not merely of her primary education, but also of that most valuable asset of the national welfare—her middle and higher schools; so that each and every grade of education, and each and every type of school, may have a clear presentment before it, both of the function which it is intended to fulfil, of the results which it is framed to produce, and of the area which it is created to supply. Thus, and thus only, can each and every school, and each and every grade of education, have its due share of national interest and assistance, and be enabled effectually to play its due part in national development."

Consult the Expert.—"If only the central authority is permeated with practical knowledge and experience of school life, and if the regulations of administration are constantly modified by conference with persons engaged in actual teaching, no such evil results will arise."

A Parsimonious Local Authority.—"It is not in Switzerland, as it still is with us, the greatest of all economies in the hands of a parsimonious local authority to cut down the teaching staff; as the rural school salaries are not kept so hopelessly behind those of the town schools, the country folk have a better chance of getting good teachers."

Conclusion.—From what has preceded, it will be safe to expect that the not inconsiderable though unconsidered question of education will suffer no neglect at the hands of Mr. Morant when he is at the head of affairs, but rather that he will emulate the Germans in saying, "Für die Schule ist nur das Beste gut genug," seeing that he has "a heart to resolve, a head to contrive, and a hand to execute."

IS IT POSSIBLE TO IMPROVE THE TEACHING OF ENGLISH COMPOSITION?

BY CLOUDESLEY BRERETON.

THE Romans had pre-eminently the bump of construction. Whether it was some Julius Cæsar devoting himself to the gigantic task of empire-building, or a mere Balbus engaged on the humbler business of raising a wall, their architectonic skill is indisputable. What they aimed at was putting together something which was solid, compact, and a whole in itself. They carried over this building instinct into their literature, and the French, who in these matters are the residuary legatees of Roman traditions, are easily the first nation in Europe as far as the sense of form

and structure in literature is concerned. Any one conversant with the working of the French secondary schools must recognise that composition in the mother tongue has been brought to the perfection of a fine art unknown in other countries. No better proof of the value they attach to the practice of composition can be given than the fact that the second highest class in a French *lycee* goes by the name of *la rhetorique*, or, as we should translate it, the composition class. A very good notion of how structure is taught and insisted on in all classes, from the lowest to the highest, may be gathered from an illuminating article on the subject by Mr. P. J. Hartog in *The Fortnightly* for July 1902.

Why is it that essay-writing, in the great majority of English schools, is both in form and subject-matter so immeasurably below the standard of achievement in French schools? One reason is, no doubt, the miserably inadequate time devoted to the subject. Another is the absence of proper training. The average schoolboy essay is written on what may be described as the inspiration theory. There is a beginning, represented by an awkward plunge *in medias res*, of what schoolboys would call the "pitch on your chest type;" of middle there is none, unless the whole essay be regarded as an undivided middle; and the end comes when inspiration runs dry. The essay resembles a wounded snake that drags its slow length along, if it is not even more invertebrate.

A still more potent reason is the theory that so largely obtains in the big public schools, that one's own language is best learnt through the medium of another. One might as soon insist that nature is best seen through spectacles. This fallacy takes the form of insisting on practice in translation out of a foreign language as adequate preparation for composition in one's own. One has no desire to decry translation as translation. It is a splendid exercise in the practice of matching *nuances* of thought in two different media of expression, and in cultivating a delicate sense of shades of meaning. But translation by itself is insufficient, as is also the falsely-called "composition" in classics or modern languages—which is really not composition at all, but only another form of translation from the mother tongue into a foreign language. Its defects are several. It narrows down the student's idea of style to the aiming at mere verbal prettiness, and the construction of a sort of clever mosaic of exact reproduction. The more important side of style, not the mere stringing together of words into sentences, but the building up of sentences into paragraphs, and of paragraphs into an organic whole, is practically lost sight of.

The æsthetic side often suffers. The sight of a page of Latin or Greek calls up to a student educated on these lines the idea rather of an elaborate patchwork of grammatical constructions than of a torso of artistically-expressed thought. He cannot help looking, like a verbal botanist, at the fibre and form of the words, instead of at what they really represent from the literary standpoint. Again, the translator, however respectable his translation, is always stretching and straining the language into which he translates in order to make it accommodate itself to the turns and twists of the language from which he is translating. Hence an English boy kept too exclusively translating French into English would probably end by giving a foreign cast, not only to his English translation, but also to any original English he wrote. On the other hand, he might do a vast deal of translating English into French, and yet never acquire anything like an approximately good French style, so far remote is the ordinary so-called French composition from what is really literary French. In a word, the one incurable defect of translation is that it never teaches a person to think in the language into which he translates; whereas one of the things indispensable to good composition is the ability to think directly and freely in the language in which one composes, without the intervention of the distorting medium of another language. This explains why, to a large extent, the average public schoolboy is so lacking in power to express himself in a literary fashion, either by word of mouth or on paper. Take him off his slang and he is practically aphone.

What is the remedy for this? The first step is to introduce into the teaching of all languages, native and foreign, living and dead, the use of the spoken word. This is no new revolution, but only a reversion to the methods of earlier times, when Latin was taught in the schools as a spoken language—a practice to which we may possibly return sooner than some people think, judging by several excellent text-books that have lately appeared. No doubt the renascence of this idea must be largely credited to Professor Vietor and his epoch-making pamphlet on the teaching of languages, entitled "*Quousque Tandem; or, The Teaching of Languages must be Revolutionised.*" But as far as the teaching of the mother tongue goes, the practice has long been in force in France and America. On the other hand, it is necessary to guard against the unreasonable pretensions of certain zealots of the method, which lay them open to the charge of wishing to exalt the spoken word to the exclusion of the written, as if their chief aim were the production of potential interpreters or precocious little bagmen.

Our first principle will, therefore, be that the spoken language must enter into the teaching of composition—that is, speaking and writing must go hand in hand, or rather speaking must precede writing. It is curious to note that so perverted is our present system of education, that the ordinary student at the present time finds it easier to write than to speak, though writing is obviously the more complex mental operation. By speaking, of course, we do not mean short, jerky answers, but continuous narrative. The small boy's difficulty, in a nutshell, lies in lack of ideas, and want of power of expression and arrangement. The usual recipe for teaching composition is to set him down to an essay, say, on "The Invention of Printing," with a pen and a blank sheet of paper. The process is thoroughly unscientific. You might as well expect him to learn to swim by pitching him into the water. If he learns anything, it will be probably bad habits, which he later on will have to unlearn. But give him a story to read, and then make him close the book and retell it. The ideas are there, and he has the general plan in his head. There only remains for him to put the whole together again. When he has practised a while the art of oral narration, he should next be called upon to write out his account. In this way his vocabulary will not be painfully amassed word by word, but will be rapidly augmented by whole phrases and sentences lifted out of the stories he has read. He will soon acquire the sense of *time sequence*, thanks to reproducing the incidents in these simple tales in their proper order of occurrence. It is at this point that the ordinary historical stories should prove of extreme value. But the utility of history does not end here. It is the most effective medium for teaching *logical sequence*, or the thought-process of cause and effect. This naturally implies historical teaching, not of the bald annalist type of names and dates, but of epochs under such titles as the Struggle of the Barons, or Simon de Montfort. Science, again, may be made ancillary to the teaching of composition. Formerly science and literary training seemed to be the poles asunder, but now it has been discovered that the accuracy and careful description required by a well-written account of any experiment performed by the pupil may serve as potent aids to cultivating a habit of clear and lucid expression. Original composition may be introduced from time to time, but the subject chosen should always be one on which the pupils are in possession of a certain amount of subject-matter—such as a school journey, or a visit to an exhibition. Teachers too often forget that they cannot get blood out of a stone. An excellent idea is that embodied in Nelson's Illustrated Composition Series, in which pictures are given of which the pupils are required to give an oral or written account. The difficulties are graduated in the earlier parts by the provision of a certain amount of subject-matter.

But all this is insufficient if the pupil is not early introduced, like the French schoolboy, to the idea of following or making a plan. It should be pointed out to him that the incidents in a story must come in their proper order, and that cause and effect should not be confounded. By the inductive method the teacher may either elicit from him the skeleton of any story to be told (say one of the picture

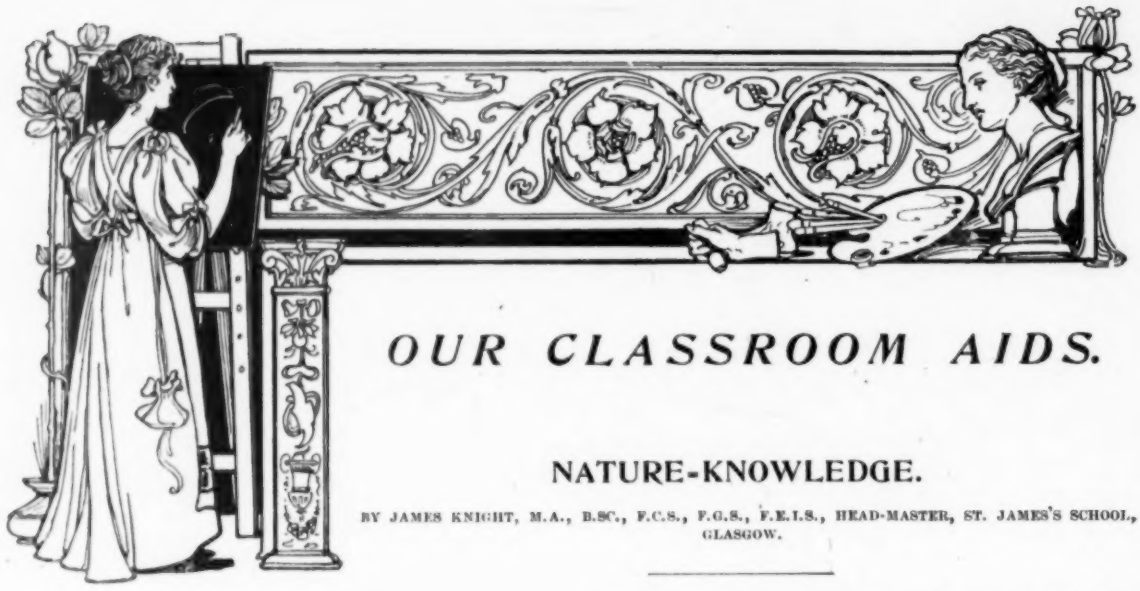
stories mentioned above) and write the principal headings on the blackboard, or he may take a story they have already read, and with the help of the pupil make a *précis* of it for the pupil to follow. But as soon as possible the pupil should be encouraged to make his own plan himself—that is, before starting to write he should think out and write down a skeleton of what he is going to say. He will soon experience the delight of being his own architect. The plan will often not be perfect, but at any rate the pupil will have got beyond what is called in the language of archæology the Cyclopean type of architecture. The skeletons furnished by some books under the headings of questions are useful, but from a practical point of view it is probably better that teacher and taught should together make the skeleton until the pupil is able to make one by himself. An excellent example of this type is what may be called the co-operative method. The teacher selects some subject like "Honesty." He asks each member of the class his ideas on the subject. These he writes one after another on the blackboard, omitting obvious duplicates. Any "corner-stone" idea that he cannot obtain directly from the pupils, he elicits by a leading question. This stage represents, so to say, the getting of the building materials on the ground. The next operation is to arrange the sentences he has placed on the blackboard in their proper order. This he does by questioning the class and numbering the sentences, to show the natural sequence in which they come. This stage is equivalent to the making of the design. And lastly he puts the sentences together, inserting the different particles (but, indeed, etc.), to indicate the mental attitude of the writer, and polishing the various phrases where necessary—an operation that corresponds to the process of actual construction. Of course, grammar and syntax will not be neglected, but they will be largely taught out of the reading and composition. It is almost superfluous to add that literature, like science and history, should furnish its quota to the teaching of composition. If we cannot hope to see the latter the central subject of the curriculum, as in France, we may certainly look forward to its educational value being more widely recognised as time goes on, and it is seen that the power to utilise knowledge is still more important than the power to assimilate it. At present we are still groaning under the tyranny of educational economics, which regard the child as a mere *consumer* of knowledge, whereas modern needs demand that he should also be a *producer*, or at least a reproducer. In this light, no subject on the literary side seems more valuable than composition, inasmuch as even when engaged in reproduction it always contains an element of originality.

There is yet another side of composition which is probably worth pointing out, because it is frequently overlooked, and that is the increased appreciation of literature produced by its practice. He who has learnt, even in an imperfect fashion, to express his thoughts and emotions, is more ready to enter into those of others; he who has learnt the use of language will best appreciate beautiful language in others. Unto him that hath, more shall be given. Thus are taste and technique in literature acquired and increased.

Paraphrase, beloved of the pedant, should be used most sparingly. It is only, in fact, our old friend translation over again, and in its least desirable form. When poetry is translated into prose, it is either a miserable parody and caricature of the original, or an explanation of the "obscurum per obscurius" type, like the celebrated paraphrase of "Twinkle, twinkle, little star," by the erudite grammarian who rendered it, "Coruscate, oh! coruscate, minute constellation in the empyrean." In nearly every case it is about as useful as putting a violet into a crucible, from the mistaken notion that the scanty residue represents the lost perfume and beauty of the flower. Once the pupil has really got hold of the idea that every piece of composition, whether oral or written, must be a connected, articulated whole, there is no reason why he should not go ahead like the French schoolboy. One caution, however, is necessary. The teacher in oral composition should let the pupil, as far as possible, stumble through by himself. Glaring faults he can point out afterwards. For the teacher to insist on his own words, or on the words of the book being used throughout, is fatal to the pupil's spontaneity. His narrative may be a poor thing, but it is his own, and that is inestimable. If some such system could be followed in those English schools which still cling to old-fashioned methods, one believes it would immensely raise the standard of the English essay, and without leading to ranting on the part of the pupils, greatly increase their power of self-expression, both in writing and speaking. This outline is, indeed, the barest of skeletons, yet one hopes that it may help to indicate that such a scheme tends to promote the acquisition of ideas simultaneously with adequacy of vocabulary, and the sense of arrangement, proportion, and constructive unity.

A SUMMER COURSE OF NATURE STUDY.

UNDER the auspices of the Hartley University College, Southampton, a summer course of nature study was held at Sandown, Isle of Wight, from 2nd to 16th August 1902. The Brading School Board kindly placed their Higher Elementary School at Sandown at the disposal of the organisers of the course, and as the building is exceedingly well fitted up and provided with a large central hall, lecture-rooms, and laboratories, it proved well adapted for the lectures and the indoor practical work. Sandown itself is an ideal centre for nature study. In the immediate vicinity one has the sea, with its diverse fauna and flora, the sand plants, seaweeds, and seashore animals. The environs also furnish one with an epitome of the Secondary and Tertiary strata of England; and in addition there are close at hand typical bog flora, chalk-down flora, cornfield flora, and ponds with their animal and plant inhabitants. Students made their own arrangements respecting board and lodgings, and varied accommodation could be obtained in the town of Sandown and neighbourhood at reasonable rates. The work of the course was divided into two parts. In the morning there was a lecture, followed by practical work on the subject dealt with in the lecture. The afternoons were devoted to excursions. During the first week five lectures were delivered on the structure and functions of a flowering plant treated in an elementary manner. The practical work consisted in the making of microscopical preparations of plant cells and tissues. During the afternoon excursions were made to places of interest in the neighbourhood, and the plants and animals studied in the living state. Botanical excursions during the first week were conducted to Sandown Common, for bog and heath plants; to Culver Cliff, for chalk-down plants; to Sandown Bay, for seaweeds; to St. Helens, for sand plants; and in the vicinity of Sandown the cornfield flora was investigated. Students were advised not to make collections or long lists of scientific names of plants, but to devote their energies to the observations of biological phenomena of interest, such as the various processes of pollination, the adaptation of the plant to its environment, etc. One afternoon was devoted to a delightful visit to the Roman villa at Brading. Subsequent to the geological lectures, excursions were made to Alum Bay (whole day), Sandown Bay, Whitecliff Bay, and the landslip. The broader geological phenomena were considered, and the students' energies were directed to the consideration of the past physical geography of the island. From the study of strata one was led to review the various changes the island experienced in Secondary and Tertiary times. The class was well attended, and students came from all parts of England and Wales. The towns of London, Leeds, Ripon, Lincoln, Chippenham, Malmesbury, Winchester, and Bridgend were represented. Although there were one or two amateurs, the majority of the students were of the teaching profession. They comprised one of His Majesty's Inspectors of Schools, lecturers from training colleges, head masters and mistresses from secondary schools and elementary schools, and assistant teachers from each kind of school. The course seems to have met the wants of the students in a thoroughly acceptable form. In some instances students received grants from their respective county councils.



OUR CLASSROOM AIDS.

NATURE-KNOWLEDGE.

BY JAMES KNIGHT, M.A., B.SC., F.C.S., F.G.S., F.E.I.S., HEAD-MASTER, ST. JAMES'S SCHOOL, GLASGOW.

PARTS OF A FLOWER.

THE pupils have learned that certain parts of a plant have to do with the individual life of that plant; they have now to study those parts which have to do with the preservation of the race. The vegetative organs are more especially the roots, stem and branches, and the leaves; the reproductive organs are popularly called flowers.

Under the term "flower" pupils readily recognise such common forms as buttercup, wallflower, rose; they have to be taught the difference between these simple flowers and such compound forms as are shown in the daisy and dandelion. They have further to recognise as flowers those inconspicuous forms, generally greenish, exhibited by such common plants as the grasses, rushes, sedges; by such others as dog's mercury and plantain, and especially by the whole group of forest trees grown for timber rather than for fruit. Every boy knows that an acorn is the fruit of an oak, but he has very rarely seen the flower of that tree, and is just as likely as not to say that an oak has no flowers at all.

We begin with an examination of some simple and well-known forms. Take a common buttercup, including under this name *Ranunculus acris*, *bulbosus*, and *repens*, all of which show what is wanted. Beginning with the top of the flower-stalk, observe the five green leaflets which form the base of the flower, sometimes spreading, sometimes bent back on the stalk as in *R. bulbosus*, covered with hairs, and closing over the central parts when the flower is immature, and even in many cases closing still by night or on the approach of rain. These are the five sepals, together forming the calyx or cup. Botanists denote this by the letter K, for the German *kelch*, a calyx, and they add the figure which represents the number of sepals, in this instance K 5. Sometimes the sepals are so entirely joined that the calyx is all of a piece, though lobed, and the separate sepals cannot be torn off. In that case the formula used is K (5), the parentheses marking union. Now take a look at the base of the sepals to see how they lie with respect to each other, and to the coloured leaves within. In the first place, they arise at the same level—that is, they are not arranged in a spiral, as most foliage leaves are, but in a whorl; and this arrangement will be found to prevail through all parts of the flower. Next, the coloured leaves or petals are not opposite the sepals, but spring from the central cushion opposite the spaces between the sepals, so as to alternate with these.

Having established these two facts, draw on a piece of white paper a circle about two inches in diameter, divide it roughly into five equal parts by radii, and then lay on its circumference the five sepals, properly arranged. If a bottle of gum, or better a tube of seccotine, is at hand, fix down the sepals with a slight touch of the mixture.

Now examine the coloured leaves. They are also five in number, are much larger than the sepals, are bright golden yellow, glossy, hollowed to form the well-known cup, and bearing a small scale near their inner base. Each of these yellow leaves is a petal, and together they form the corolla (C); they are, in fact, what most people call the flower. Since the buttercup has five petals at regular intervals, its formula will be C 5, so far as the corolla is concerned. Now draw a second circle within the first and concentric with it, and insert the five petals on it, taking care to put them opposite the spaces left between the petals. These two whorls of green and yellow leaves, sepals and petals, calyx and corolla, are often called collectively the perianth or perigyne (P). They are protective and attractive in their use, but so far from being the real flower, they may be absent altogether. The real flower consists of two further sets of floral leaves, which have been modified to form real reproductive organs, and these we now examine.

Within the corolla ring, plainly visible when the petals have been dissected, there are some twenty or so thread-like stalks called stamens, each bearing at its outer end a small vessel, generally yellow or brownish when ripe. This vessel is an anther, and it contains the fertilising dust called pollen, so we may call these vessels pollen-baskets or pollen-sacs. The pollen dust may be readily brushed off with the finger, and its uses will come up for study in a subsequent lesson. The stamens in the buttercup are not easily counted, but there are at least a score, and we denote them by the formula A 20 or A ∞; the latter sign, "infinite," being used when the number is over a score. By careful dissection we discover that the stamens form several whorls of five each, three or four as the case may be, when dealing with the Ranunculus family. Draw other three concentric circles, and proceed to gum down the anthers only, since the whole stamens would prove confusing. This will give fifteen stamens, which will be sufficient for our general purpose at present. These show the *andræcium* (A) or male portion of the flower, leaving still on the flower-stalk the central *gynæcium* (G) or female parts.

This central portion is seen to consist of several whorls of little green leaves, called carpels, folded up so as each to make a hollow tube containing ovules or plant eggs. The whole carpellary leaf is often called a pistil, but attention should be drawn to the fact that each carpel is after all only a special kind of leaf. Now glue down in the centre, say, two or three rows of these carpels, denoted by the formula G ∞, and the mapping of the buttercup is finished. Its complete botanical formula thus runs—K 5, C 5, A ∞, G ∞. The absence of brackets shows that all the parts are separate, the flower is complete, wanting neither sepals nor petals, and regular, as is shown by the arrangement of the parts with respect to our circles. The mounted sepals, petals, etc., show the ground plan of the buttercup, and are the first step towards the construction of a proper flower-map or floral diagram, as botanists call it, having much the same relation to this as the bird's-eye view of a country has to an ordinary map.

Now take up your compasses and trace out several concentric circles, at least eight in this case, differing by small and equal amounts of radius, and then divide these radially into five sectors. Insert the various carpels, stamens, etc., as shown in Fig. 1, marking the back of the leaves by a slight ridge, and using the signs shown for stamens (really anthers) and carpels. This is a genuine floral diagram, and should always be shown as the finished result of any flower dissection. For the sake of

simplicity, only three whorls each are shown of the stamens and carpels.

Observe that this particular flower runs in fives, and contrast

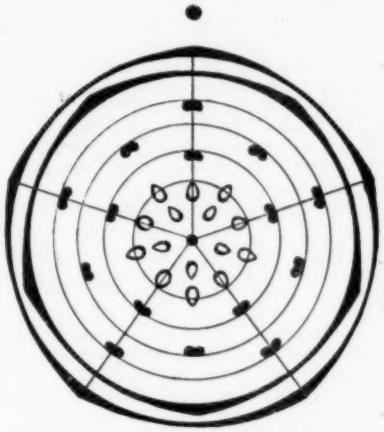


FIG. 1.—FLORAL DIAGRAM OF BUTTERCUP.
(K 5, C 5, A 15, G 15.)

it with the fourfold system of wallflower and the threefold system of a white or tiger lily. Taking the buttercup again as a type, show some others of the Ranunculus family, so as to bring out individual differences along with agreement with a general plan. Take, for instance, the marsh marigold (*Caltha palustris*), whose large size renders it specially useful for class work. Here the formula is K 5, C 0, A ∞, G ∞; that is to say, the petals are wanting, and so the sepals have taken on the yellow tint, become petaloid, as the books say, in order to keep the flag flying. The common clematis is another large flower of the same order, suitable for class demonstration. Here the irregularity is more marked, the formula being K 4, C 0, A ∞, G ∞. One of the sepals has disappeared, the others are extra large and petaloid. Lastly, the lesser celandine or pilewort (*R. ficaria*), one of our earliest spring flowers, is still more irregular, though still a member of the family. It has from three to five sepals, generally three; eight to twelve petals; and stamens and carpels as usual.

Now, for a change, take a wallflower. Here there are four sepals in two whorls—outermost a front and back sepal with reference to the plant stem, then two lateral sepals, right and left. Within these come the four whorled petals of the corolla. Then come two long stamens which arise opposite the side sepals, and within these are four shorter stamens, all on the same level and of the same length. Lastly, the carpels, when cut across, show two compartments, very well seen in the fruit or seed-pod, which generally preserves on a larger scale the arrangement of the carpellary leaves. Fig. 2 shows the floral diagram of a wall-

FIG. 2.—FLORAL DIAGRAM OF WALLFLOWER.
(K 2 + 2, C 4, A 2 + 4, G 2.)

flower, and its formula may be written K 2 + 2, C 4, A 2 + 4, G 2. The ovules are shown in position within the carpels, while the black dot outside the diagram in both figures shows the position of the stem from which the flower-stalk springs.

Thirdly, take a flower of the three type, as shown in the tiger and orange lilies, tulip, crocus, iris, and many large flowers, eminently suitable for class purposes. Taking a garden iris, we have on the outside three coloured leaves which may be either petals or sepals, since in the latter case they are petaloid. These are broad, large, and turned back towards the flower-stalk, whereas the inner whorl of three petals proper are smaller, narrow, and more erect. Then come three stamens opposite and indeed attached to the three sepals. Lastly, the pistil consists of three carpels which terminate in broad petaloid leaves arching over the stamens and hiding them from view. The formula in this case, using the symbol P for perianth, instead of distinguishing sepals from petals, would be P 3 + 3, A 3, G 3, as shown in Fig. 3, which, indeed, might stand for the whole lily class almost without exception.

While dealing thus with a tripartite flower, the teacher will be careful to point out the essential differences in build between such plants and those with five or four partite flowers—such differences as the venation and arrangements of leaves, the character of the roots, in older plants the diverse modes of growth as seen by a cross-cut of stem, and all the other features which distinguish the monocotyledons and dicotyledons.

Besides the three great types of flowers given above, samples should be exhibited of the great divisions of dicotyledons. For Thalamifloræ the teacher may select a ranunculus as above, water-lily, poppy, any of the Cruciferæ, such as the wallflower, stock, or nasturtium, the violet, pink, mallow, garden balsam, all of which are suitable for class work. As examples of Calycifloræ, some of the larger Leguminosæ or pod-bearing plants, such as the pea, may be selected, or one of the great Rose tribe, including not only roses, but such common flowers as bramble, hawthorn, strawberry, and most fruit-trees—apple, plum, pear, etc.

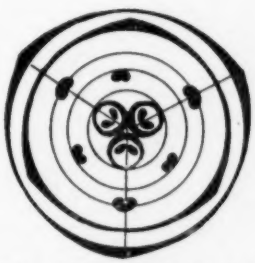


FIG. 3.—FLORAL DIAGRAM OF IRIS.
(P 3 + 3, A 3 + 3, G 3.)

The Gamopetalæ, which have all their petals united into one piece, with the stamens inserted on it, are represented by the honeysuckle, campanula, including the harebell and the garden Canterbury bell (the latter specially useful from its size), primrose, pimpernel, phlox, and convolvulus, besides the very interesting Compositæ or compound flowers, which require further treatment. Next come the incomplete flowers, which lack either sepals or petals, or both. These include dog's mercury, dock, mistletoe, rhubarb, and many timber trees with inconspicuous flowers, such as elm, sycamore or plane tree, walnut, birch, alder, oak, beech, chestnut, hazel, poplar, and the many kinds of willow. For the monocotyledons teachers have a wide selection, comprising the lilies, lily of the valley, tulip, hyacinth, narcissus, snowdrop, iris, crocus, as well as orchids, sedges, and grasses, which have floral diagrams rather difficult, not to make, but to comprehend, owing to the omission of several members.

Teachers will find Oliver's *Systematic Botany* (Blackie) especially useful in the construction of these diagrams; but such a text-book should be used as a "crib," to correct original work, not to anticipate or save it.

THE President of the Board of Education has re-appointed as members of the Consultative Committee, established under the provisions of the Board of Education Act, 1899, the following gentlemen, whose terms of office expired on September 30:—The Right Hon. Sir William Hart-Dyke, Bart., M.P.; Ernest Gray, Esq., M.P.; Arthur Charles Humphreys-Owen, Esq., M.P.; the Hon. and Rev. Edward Lyttleton; the Venerable Ernest Grey Sandford, Archdeacon of Exeter; and the Rev. David James Waller, D.D.: and has appointed Thomas Herbert Warren, Esq., President of Magdalen College, Oxford, as a member of the Committee, in place of Sir William Reynell Anson, Bart., M.P., resigned.

A LESSON ON THE STUDY OF A PICTURE.

"THE LAST IN." (William Mulready, R.A., 1786–1863.)

BY FRANCIS J. FROST, B.A. (OXON.),

Head-Master, Pupil Teacher Classes, University College, Reading.

See Supplement presented with this number.

BEFORE giving the following lesson, the teacher should make himself acquainted with the interpretation of the picture, and with some of the main principles by which the artist is guided, and which are illustrated in this picture.

I. Interpretation.—The picture represents a village school of long ago. Lessons are being interrupted by a late comer, "The Last In;" and the schoolmaster, who looks as though he may be the village parson, is in the act of rebuking the boy by gentle sarcasm. The tall girl on the right of the picture seems to appreciate the seriousness of the offence and the mixed feelings of the urchin at the door, though she is unconsciously imitating the master in look and action. Her face is a fine study of character. Schoolboy nature is here depicted in the three boys in the foreground. One has "gone to sleep," and is quite oblivious of every one else, while the other two seize so favourable an opportunity for a private interlude.

II. Artistic Principles Illustrated.—(*a*) There is *one central idea*, and the *accessories are subordinated* to it. At first sight the eye naturally seeks the centre of the picture. The strange attitude of the master directs the eye to the object of his attentions, and the boy's face and manner at once betray him. He is "The Last In" evidently. Possibly the eye may first catch sight of the beautiful girl in the high light. But if so, then you are led by her attitude and the direction of her looks to the two other important actors in this scene.

The details are sufficient to make clear that the scene is that of a village school. The boys with books and bag, the little girl knitting, and the open country have each and all a small part to play, but they do not thrust themselves into notice.

(*b*) *Nature forms the basis*, but has *not been merely copied.* Had the artist merely copied some village school, there would be little more than historical interest in his picture. But he has, by the power of his imagination and the genius of his art, transformed a commonplace scene into one full of interest and of beauty. Never, perhaps, except in the artist's mind, did such a school exist.

(*c*) There is *one principal light*, and the *masses* are *harmoniously arranged.* Compare the three principal figures in the high light, while the black mass in the centre stands in contrast with the white figures on the right. The subdued light through the opening gives depth and further interest.

The Lesson.

The *aim* of the teacher should be to make the pupils acquainted, as far as possible, with the facts mentioned above, but in such a way as to provide good exercise for the imagination.

I. Preparation.—1. Show the picture, with title hidden, for a minute or two. Then set pupils to write down their first impressions.

2. Repeat this, and let pupils write down any new impression.

3. This may be repeated again, giving somewhat longer time for study.

(By this means the pupils are likely to grasp the more prominent features of the picture, which will come into greater and greater clearness at each fresh study. The teacher should make use of these stages of clearness during the presentation, when he should correct faults and show the relation between the prominent features and the artist's devices.)

II. Presentation.—State title of picture. Ask to whom it refers. Ask how it is that the old man, the girl, and "The Last In" attract attention first.

(*Associate* with last picture lesson to illustrate the way in which the artist places his figures in order to guide the eye. If possible, show some other picture which strikingly illustrates this point.)

Call upon some pupil to describe the attitude of the schoolmaster, and, if possible, to explain.

(The teacher may find it necessary to call on a scholar to represent "The Last In," while he himself greets the late comer in the spirit of the picture. Associations of this sort are always very telling, and some of the pupils will appreciate the humour of the scene only by this means.)

Ask—"Judging from the face and manner of the boy at the door, say what are his thoughts."

"By what artifices does the painter draw attention to the boy at the door?"

(Compare high light and the play of the principal figures towards him.)

Invite some explanation of the attitude of the girl. Her face should be closely studied. What do you infer as to her thoughts? (If necessary, let some one imitate her.)

The teacher might cover up the girl's face and neck, or tell class to imagine her standing quite upright. What difference would a change of this sort make to the picture? (The graceful bend of the neck helps to sweep the eye round the curve which flows from the busy boys through the girl and master to "The Last In.")

Ask if the pupils feel that there is any inconsistency in the picture. (Here show that this is not a mere portrait of any school, but a work of art—something more beautiful.)

Ask scholars to look away from the picture. Then inquire which are the objects that they most easily call to mind. (One mark of a good picture is that details do not draw off the attention, but play their part unobtrusively.)

III. Association.—This has been indicated at various parts of the presentation. But associations occur to teachers like inspirations, at the moment of teaching; and usually they are better than any one can suggest.

IV. Formulation.—Call upon individuals to mention the noteworthy points dealt with during the lesson, and arrange a summary on blackboard. (A summary might be made during the presentation.)

"The Last In."

Picture of village school at beginning of nineteenth century. An ideal rather than an actual school.

"The Last In" is greeted by his master with mock salutation.

This the boy fails to understand, but appears to feel his position keenly.

The beautiful girl on the right, while unconsciously imitating the master, seems somewhat sorry for the late boy's confusion.

The *artist's skill* is shown—

1. In making an ordinary commonplace scene full of beauty and interest.
2. In that he has made the various persons, by their attitudes and expressions, and the other objects in the picture, all combine to make clear the one central idea.
3. The accessories do not thrust themselves on our notice.

V. Application.—1. Find other suitable titles for this picture. (For example, "An Incident in a Village School," "A Humorous Reproof.")

2. Set students to study the various details of the picture, and to explain their value in the picture (for example, the uncouth lad outside, the dog, the woman in the background, the occupation of the various persons other than the chief figures).

3. Is there anything inconsistent about this picture? Give such details as occur to you (for example, the refined figures and faces, the thin dresses).

4. Scholars might be set to find out something about the life of the artist.

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A COURSE OF OBJECT LESSONS FOR GIRLS' SCHOOLS.

BY WILLIAM DONE, B.A.,
Head-Master of Brighton Pupil Teachers' School.

XXXIV. MATTER: SOME OF ITS CHIEF PROPERTIES.

Articles of Illustration.—Pieces of glass, lead, iron, cork, sponge, leather; substances with peculiar characteristics of taste or smell, such as salt, sugar, camphor; a piece of polished wood or a smooth ruler; a ball; a glass jar with wide neck.

Experiment and Observation.	Result and Inference.
Place on the table two small heaps, one of sugar, the other of salt, both in a finely-powdered condition. The girls are to suggest a ready means of identification.	Various things have *tastes* of their own, or, as we might say, peculiar to themselves. We should never mistake sugar for salt, apple for pear, if we tasted them.
Stand two or three girls in front of and facing the class. With their eyes closed, let these girls name by means of smell articles such as camphor, leather, etc.	Many substances have characteristic *smells*.
Let the same girls pass their hands over the polished surfaces of pieces of glass and wood, and thereby discriminate between the two substances.	As long as the eyes are closed the glass cannot be distinguished from the polished wood, but on opening the eyes it is found that each of these articles has an *appearance* of its own: glass, for instance, is transparent.
Give a ball to a girl who has her eyes closed, in order that she may find out its shape by feeling.	Some things have distinctive *shapes*.
Refer to pounds of sugar, tons of coal, ounces of tea, etc.; also mention the terms *heavy* and *light* applied to things.	All these substances have *weight*; in fact, we cannot think of anything which does not possess some weight—that is, a tendency to fall to the earth.
Put pieces of chalk, wood, sponge, iron, etc., into the glass jar until it is full. Why do we say the jar is full?	The various articles placed in the jar have taken up all the room. All substances *occupy space*.
Take these things out of the jar and place them on the table. Why was it necessary for the teacher to take them out if she wanted them to change their position?	These materials cannot move of their own accord. We have to use force to lift them or push them; they *offer resistance*.
Break a piece of chalk into fragments. Continue to divide these particles, questioning the class meanwhile as to how far it is possible to do this.	All substances can be divided into parts; and there seems no end to this division, for when the particles get too small for one to see naturally, they will still seem large under a microscope.
Experiment again with sugar, so as to show that the qualities of a substance are the same in its particles as in the mass. The term *molecule* might be introduced if desired.	All substances are composed of molecules, and the molecules have the same distinctive qualities as the substances themselves.
Enumerate the various articles with which we have been experimenting, and ask for a common name which will include not only these substances, but any others.	Such words as *things*, *substances*, or *materials* might be used to include what we have been experimenting with. [Teacher to say that the term *matter* is perhaps the best to use.]
Collect up the chief characteristics common to all the substances shown or experimented with in the lesson.	We have found out that all things— (*a*) Have size; (*b*) Possess weight; (*c*) Take up space; (*d*) Can be divided into particles; (*e*) Do not move of their own accord; (*f*) Offer resistance. All these things may be called *general qualities* or properties of matter.
Refer to the fact that the girls discovered that some things could be distinguished from others by reason of peculiarities of smell, taste, touch, etc.	Different forms of matter have also *special properties* in addition to common properties.
Give to each girl in the class a specimen of some substance. Let them severally test these things in any way they think fit, to find out general or special properties.	The answers given by the girls may lead to the discussion of further qualities of matter, such as *porosity*, exemplified in the sponge; *compressibility*, shown well in the sponge and the cork, etc.

XXXV. MATTER: ITS THREE FORMS.

Articles of Illustration.—A piece of ice; some water, a kettle, and means of heating the water; a basin; some methylated spirit; a German flask.

Experiment and Observation.	Result and Inference.
Some time previous to the lesson put a piece of ice into the kettle and apply heat, so that the resulting water may be boiling and steam issuing by the time the lesson commences.	The solid ice was changed by heat first into water (a liquid), then into steam (a vapour).
Heat a little water in a flask. When boiling, note the invisibility of the vapour in the flask.	The steam was not visible until it issued from the flask into the air. A similar thing is noticed with the vapour from a railway engine; sometimes there is a good space even between the funnel and the visible steam.
Hold a cold slate just above the flask.	Little drops of water are formed.
Repeat the experiment with a piece of hot slate.	There are no drops of water formed. The steam changed back again to water in the former case, owing to the cold slate cooling it down. Thus, also, the cooler air turns the steam issuing from the flask into little drops of water, which look altogether like a white cloud, though we generally call this white cloud the steam.
Refer to ponds, rivers, etc., freezing in very cold weather.	Water losing its heat will be changed into ice, as ice may be changed into water and steam by means of heat.
Drop a few spots of methylated spirit on the backs of some of the girls' hands.	The spirit quickly disappears without any heat being visibly applied. The skin feels very cold, however, just where the drop of spirit was. [Teacher to assist the reasoning: the heat from the skin has vaporised the spirit.]
Refer to clothes drying after being washed and hung out in the air, to puddles of water drying up, etc.	Water will turn into vapour at ordinary temperatures, only more slowly than when heat is directly applied.
Ask for names of other common materials which exist in more than one form.	Butter and other fats are known both in the solid and in the liquid form, and we know from our previous lesson on a candle that fats such as tallow pass into a vapour before turning into flame. Even such a substance as iron can be melted, so perhaps all materials can exist in three forms. [Teacher to confirm.]

Experiment and Observation.	Result and Inference.
Ask for names of other things known to the girls which are always in one state at ordinary temperatures.	In ordinary life air is always a gas or vapour, quicksilver a liquid, and many well-known substances are always solids.
Place a piece of ice first in a basin, then on a plate. Put water into similar objects. Ask for differences in the behaviour of ice and water under these conditions.	The solid keeps its shape, while the liquid takes the form of the vessel in which it is placed. The little particles of which things are composed hold together better in solids than in liquids.
Turn on the gas for a minute or so, until it can be smelt by the girls in the class.	The little particles of a vapour or gas tend to spread themselves out indefinitely.
Sum up the results of the last two experiments.	(*a*) In a solid the particles are held firmly together. (*b*) In a liquid the particles are practically only just touching each other. (*c*) In a gas the particles tend to get as far apart from each other as they can.

PHYSICAL TRAINING.

A PROGRESSIVE COURSE FOR ELEMENTARY SCHOOLS.

BY H. RIPPON SEYMOUR, A.C.,

Chief Instructor, George Watson's College, Edinburgh; Member International Congress of Physical Education, Paris, 1900; Author of "Physical Training," etc.

NOTE.

THIS course will consist of two series of exercises—(1) a course of military drill adapted to the needs of elementary schools; and (2) a course of physical and free gymnastic exercises. In both courses care will be taken to make the exercises suitable for schools with a minimum of apparatus, and the explanations will be sufficiently clear to be of service to teachers without any special knowledge of drill and gymnastics.

The words in heavy type are the commands to be given by the teacher, and must be pronounced loudly and distinctly. As a rule, the last word of a command is the executive word, and a pause should be made before it.

Any command which consists of *one* word must be preceded by a cautionary word—for example, "Class—Halt."

The caution should be given slowly and distinctly, and the last or executive part of the command sharply, as this has much to do with securing sharp and simultaneous action in the class, a pause marked thus — being made between the cautionary and executive words.

FIRST LESSON.

The Elements of Military Drill adapted to Children's Use.

FORMING A CLASS FOR DRILL.

1. "**In Single Rank—Fall in.**"—Place the right-hand pupil in the required position, and order the remainder to take their places quietly side by side, with a space of about an inch between each boy and the next.

THE POSITION OF "ATTENTION" (Fig. 1).

It is most important that this position should be thoroughly understood by each pupil. It is the foundation of a correct carriage and bearing, and is therefore explained at length.

2. "**Class—Attention.**"—On this command the pupils will assume the following position:—The body must be held erect, the hips somewhat drawn back, the breast slightly lifted and advanced, without constraint or undue rigidity. There should be a slight forward inclination of the body, the

Fig. 1.

greater portion of the weight being borne by the fore part of the feet.

The chin should be drawn in, the head being erect; the arms nearly straight, and hanging easily from the shoulders; the hands half closed, the thumb touching the forefinger and turned forward, so that the back of the hand cannot be seen by the teacher when in front.

The legs should be straight, with the knees braced back, the toes turned out, forming an angle of rather less than 45 degrees. The eyes should be directed straight forward to a point slightly above the pupil's own height.

DRESSING.

3. "**Right—Dress.**"—On this command all the pupils (except the right-hand one) will turn the head and eyes to the right, without movement of the shoulders, and will then gradually move the feet forward or backward until they can just see the lower part of the face of the second pupil from them. When the teacher sees that the line is straight, the command will be given—

4. "**Eyes—Front,**" when the head and eyes are to be turned quickly to the front.

NUMBERING THE CLASS.

5. "**Class—Number.**"—The pupils will be instructed to call out in a distinct tone their numbers consecutively from the right of the class, commencing with No. 1. The heads should not be turned either to right or left whilst numbering.

In order to prepare for various formations which will be explained in later articles, the pupils may be desired to number in threes, thus: 1—2—3, 1—2—3, etc.

When the class is formed in two ranks, the rear-rank pupils do not call out their numbers, but take that of their partner in the front rank.

OPENING THE RANKS FOR EXERCISES.

There are several methods of opening ranks, but the following, being perhaps the most simple, is most suitable for our first lesson with one rank:—

6. "**Odd Numbers one Pace Forward, Even Numbers one Pace Step Back—March.**" The odd numbers will take a pace to the front, and the even numbers a pace to the rear, in both cases the *left* foot moving first, followed by the right.

When the pupils thoroughly understand this movement, the command may be given more simply, as follows:—"**Open Out—March.**"

TO RE-FORM THE RANKS.

7. "**Re-form Line (or Ranks)—March.**"—The foregoing movement is reversed by the odd numbers stepping back and the even numbers forward.

The movements of "opening out" and "re-forming line" should be practised repeatedly until the whole of the pupils move in unison.

RESTING OR "STANDING EASY" (Fig. 2).

8. "**Stand—Easy.**"—Carry the left foot eight or ten inches to the left, the weight of the body resting equally on

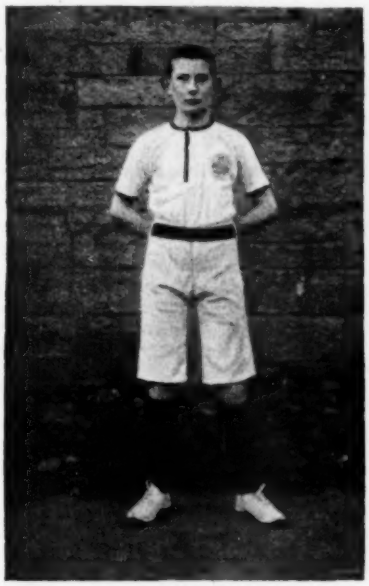


Fig. 2.

both feet, and at the same time place the hands behind the back, the left hand resting against the back, lightly holding the right hand in its grasp.

TURNINGS.

9. "**Right—Turn.**"—The pupil will turn the body a quarter circle to the right, making a pivot of the right heel, and immediately bring up the left foot to the position of "attention," making a beat or slight stamp with this foot to ensure that the movement is simultaneous. This movement should be followed by "front," as described in Ex. 11 below.

10. "**Left—Turn.**"—Turn a quarter circle to the left, the left heel acting as a pivot, and the right foot being brought up with a beat to the position of "attention."

A turn to right or left from the front brings the class into "file."

11. "**Class—Front.**"—On the command "Front," the class will turn either "right" or "left" to their original front.

MARCHING (QUICK TIME).

12. "**Quick—March.**"—At the word "march" the whole class will step off together, the first pace being always taken with the left foot; and in order to ensure that every pupil shall start at precisely the same moment, the first step with the left foot may be taken with a firm beat. No stamping should be allowed after this, however.

Extreme rigidity is no longer considered essential to correct marching, and rightly so. The arms may be allowed to swing easily from the shoulders, the hands not rising higher than the waist, or being swung in advance of the leading foot. They should swing only very slightly *across* the body, but mainly from front to rear. The body should almost imperceptibly incline forward, and must not be allowed to roll from side to side.

The legs must swing forward from the hips, and the whole movement be free and natural.

No absolute rule can be laid down as to length of pace for children, but twenty-four inches may be taken as a fair average between the ages of ten and fourteen.

13. "**Mark—Time.**"—On the command "Mark—time," raise the feet alternately three or four inches from the ground without advancing or retiring, and observe the same cadence as when marching.

The pupils towards the rear of the class will take this opportunity of "closing up," as they will probably have lost ground somewhat.

To resume marching, the command "Forward" should be given on the left foot meeting the floor, when the class will move forward together by stepping off with the left foot the next time it reaches the floor.

THE HALT.

14. "**Class—Halt.**"—The word "Halt" should be given when the left foot has just reached the floor. The right foot will then take a pace forward, and the left foot complete the movement by closing the heels. A complete pace is therefore taken after the word "Halt," and the closing of the heels makes a second movement.

NOTES AND JOTTINGS.

As some doubt exists as to the positions that women will be allowed to occupy in the management of public education under the new Bill, we would direct our readers' attention to the following question in Parliament by Mr. Plummer:—"To ask the Secretary to the Board of Education whether, with a view of making plain the position of women in the work of public education in the future, he will state in what capacities under the provisions of the Education Bill they will be enabled to act."

He was thus answered by Sir William Anson:—"Under the Education Bill women will be eligible for the Boards of Managers of Public Elementary Schools. They will also be eligible for places on the Education Committee of the Local Education Authority.

"This is plain from the terms of the Bill. It has always been the declared intention of the Government. I may refer the hon. member to an answer given by the First Lord of the Treasury to a question in this House on the 10th of April of this year."

On November 8th, after inspecting the boys attending the schools in Omdurman and Khartoum, Lord Kitchener proceeded to open the Gordon College. Sir Reginald Wingate, the Sirdar, welcomed his Lordship on behalf of the officers, officials, and natives of the Soudan, eulogising his work in that province, and remarking that he became the first British successor to General Gordon. The total sum raised to endow the college was about £100,000, and the Sirdar mentioned with gratitude the handsome gifts of Sir W. Mather and Mr. Welcome. After a few more speeches, mostly by native notables, the Sirdar asked Lord Kitchener to declare the college open.

His Lordship then made an excellent address, dealing with the educational possibilities of the Soudan. He said that the people of all classes were anxious to secure education for their children, and heartily approved of the manner in which that education was being provided. In the primary schools we find excellent material to work on, and during the short time they have been established they have become as efficient as the primary schools in Egypt. He contrasted the present state of the Soudan with that in which he found it when he first made its acquaintance, and expressed the hope that the memorial to General Gordon would justify its titular rank as a college by becoming the centre of secondary education and advanced scientific training for the youths of the Soudan, who would afterwards be called upon to occupy important posts in the administration of the country. After pleading that the endowment should be kept intact, and asking for additional funds to equip a gymnasium, etc., Lord Kitchener declared the college open.

The ceremony, which was a most impressive one, took place on the spot near where General Gordon died.

We hope shortly, through the kindness of one of our contributors in Egypt, to give an account of this interesting college.

OUR FRENCH PRIZE COMPETITION.

Prize Editor—W. T. THOMPSON, B.A. (LOND.), *French and German Honours.*

Important to Scholarship, Certificate, and London Matriculation Students.

WE should like to specially direct the attention of our readers to the fact that the Board of Education, in the Syllabuses for the Scholarship and Certificate Examinations 1901 and 1902, requires "no set books" for French and German. Students preparing for these examinations, as well as students for London Matriculation, could not do better than attempt month by month the pieces set for translation here. They are from the best authors, and of varied character. A competitor who does not gain a prize can derive considerable benefit from the exercise. A study of the successful competitor's translation, and of our remarks, will help him to see where he might have done better. If desired, his paper can be returned (fully corrected) by enclosing six stamps together with a stamped and addressed envelope. Corrected papers cannot be posted until after publication of the journal.—ED.

RULES.

1. All translations should be **posted not later than Dec. 8**, and addressed:—*Prize Editor*, Office of THE PRACTICAL TEACHER, 35 and 36 Paternoster Row, London, E.C.
2. Competitors should cut out and send the Coupon which appears on the Back Wrapper page of the current number.

ALTERATION IN RULE 3.

3. Competitors should write pseudonym only on MS. Prize-winner will be asked to send name and address for publication.
4. No competitor may take the prize offered more than once in three months.

FRENCH PRIZE COMPETITION.

A Prize of One Guinea will be given for the best translation into English of the following extract:—

Ces vieilles filles qu'on ridiculise, on devrait les admirer à genoux, quand on songe aux sourdes souffrances de leur réclusion volontaire. Elles ont été jeunes, tendres, inflammables comme les autres, et elles ont vu leurs amies s'éloigner successivement avec un mari au bras. Quand le mariage de la dernière a été célébré, elles sont tristement revenues seules de l'église à leur maison muette, et il leur a fallu se résigner en pleine jeunesse. Le sang vif et précipité a eu beau gronder dans leur cœur comme dans un réservoir trop plein et muré; elles l'ont fait taire. Pour arrêter l'élan des fleurs de tendresse qui auraient voulu s'épanouir au dehors, la religion, le devoir, l'honneur étaient là; autant de grilles austères, festonnées de liserons qui ne demandaient qu'à fleurir, et qui ne fleuriront pas. Quelle douloureuse lutte intime! Et quand chaque printemps revenait, quelle amère raillerie, quelles terribles tentations, quels troubles secrets! Ainsi les années se sont amassées sur elles, automne sur automne, hiver sur hiver, jusqu'au jour où les cheveux blancs sont venus amenant avec eux un froid apaisement. Beaucoup de ces Niobés de la virginité ne savent pas, il est vrai, se résigner, et tournent à l'aigre dans leur saison mûre; mais celles qui, dans cette cruelle épreuve, ont pu garder intacte leur tendresse comprimée, celles-là sont admirables. Elles atteignent la vieillesse, comme ces arbres, riches de sève sous leur rude écorce, qui donnent après de longues années leurs fruits les plus savoureux et les plus parfumés. ANDRÉ THEURIET.

RESULT OF THE NOVEMBER COMPETITION.

The prize is awarded to "Snipe." (Will "Snipe" kindly send in name and address?)

First Class.—Frogmore, Mister O'Toole, Esmond, Chemineau, La Printanière, Nina, Polly, Gladiator, Rus, Hernani, Marly, C.E.M., Ayesbe, Mopz, Scot, Agaznog, Hessary, Dewhurst, G.I.R.L., Veronica, Nell of Tarc, Capella, Aiphos, Meg Merrilies, Wessex, Bull-dog, C.H.B., A Bhoidheach, Pellonia, Pompilia, CH_4, Arche, Puella, Kettering, Pegarita, Luck, La Chevilotte, Xavier, Olibo, Petit oiseau, Saint Cloud, Eglantine, J.H.O.D., Fertilis, Soton, Day Dawn, Débutante, Alexis, Gravesend, Mouffon, Everyman, Grimpen, Trellis, Jus de pomme, Clematis, Machar, Floreat Etona, Heliades, Osmonde, Feste, Marquise, Jessamine, Hilaris, Bonne chance, Annie Laurie, Ruy Blas, Gallois, Une écolière, Ambrosia, Alec, La paysanne, Swansea, Nom de Guerre, Ephesian, Logic, Portia, Bun Jonyan, Awa Maree, L.R.A.M., Irlandaise, Ardenconnel, Le Jolliot.

Second Class.—Marwenne, Joan, Maiden city, Etoile, Rydal Mount, We Two, Hawthorne, Knottingley, H.A.D., Nemo, Peggy, Excelsior, Dittie, Aramis, Heather Bell, Flora, L'orient, Wee doggie, Orator, Dlorah Tsenre, Portia (Ramsgate), Cedric, B.S.B., Chou-fleur, Adelaide, Expectation, Margot, Ben Venue, Nil desperandum, Tabou, Lois, Iolanthe, Gert, Jessica, Goorkha, Nylla, Claudia, Perplexed, Aliena, Marianna, Thornton, Ipse, Monega, Hague, Owensian, Nil desperandum (Lintz Green), Olivia, Hovan, Rural, Stag.

Third Class.—Godetia, Norah, Tigris, L'espérance, Morganwg.

Report.

The piece set was somewhat difficult, on account of the long and rather involved sentences contained in it. *Comme* in *comme une résurrection anticipée* was a stumbling-block to many. Here it is equivalent to "as it were." *Résurrection* is governed by *assuré*, and *fonctions* and *popularité* depend on *résurrection*. A large number of competitors insisted on translating the subjunctives *qu'elle ait*, etc., as "that she *may* have," etc. It is evident that these competitors do not really understand what is implied by a subjunctive mood. *Scellées au passé* was not understood by many. The successful competitor has given a rendering which well expresses the meaning. A few competitors do not yet understand that an author who writes in French means to say something sensible quite as much as an English author does. If they had realised this, three competitors would not have translated *Elle était femme, et elle dura* by "She was a woman, and she continued to be one."

Prize Translation.

We are now better able to understand the passionate attachment which the late queen inspired in her subjects. During the first twenty years of her reign she did not enjoy absolute, undisturbed sway over the heart of the nation. During the twenty years which followed she was misunderstood, slighted, attacked, and the influence of the crown seemed to be diminished. How was it that, at the end of the century, the queen and the monarchy together found such power to stir up enthusiasm? It is not enough to say that the privilege of her sex, her good fortune in growing old with powers unimpaired, the happy chances which served her in place of genius, restored Victoria, as by a sort of anticipated resurrection, to her queenly duties and her popularity. It cannot be doubted that in her army and among her people she kindled a devotion such as no king had ever aroused; that as a woman, widowed and unhappy, she revived the instinct of chivalry in the heart of a generation and a race naturally alien to such a sentiment. Hardly is it possible either to doubt that further, in virtue of the mighty memory of far-off deeds, accomplished under her eyes, linked to the past by her hands, exalted together with herself in the imagination of a race whose good fortune and whose pleasure it is to magnify all that concerns it, she has associated the majesty of the age with her personal greatness, and slowly added to the lustre of her crown the glory of a whole century. Twofold privilege. She was a woman, and she lasted. But others have lasted. Others have heaped up the stern advantages of age. But no reign ever closed amid such a fire of enthusiasm. In addition to the caprices of fortune, which made her sovereign of an empire and contemporary of several generations, we are compelled to acknowledge in this woman gifts of nature and excellences of character without which no working of chance, no miracle of fate, would have established her glory. "SNIPE."

Gift-Book Literature of the Season.

"The good books of the hour, then—I do not speak of the bad ones—is simply the useful or pleasant talk of some person whom you cannot otherwise converse with printed for you. Very useful often, telling you what you ought to know; very pleasant often, as a sensible friend's present talk would be."

RUSKIN, *Sesame and Lilies.*

As the Editor opens parcel after parcel of books that arrive, he thinks perforce of the oft-repeated words, "Of making many books there is no end." He feels, however, that it is a duty he owes to the readers to examine this vast array of volumes, with the help of his numerous colleagues, and indicate those books which seem especially suitable as prizes or Christmas presents.

The present season has called forth an even larger number of "good books of the hour" than usual, and we hope that the following notices will be useful in making choice of books suitable for young people of different ages and tastes.

We are glad to notice among the writers who devote their best efforts to this work for the young such names as the following:—H. Avery, Everett-Green, G. A. Henty, and Gordon Stables.

Publishers, for their part, spare no pains to make the books attractive, as witness the productions of such firms as Messrs. Blackie, Cassell, Griffith and Farran, Longmans, Macmillan, and Nelson and Sons.

BLACKIE AND SON.

The Fairclough Family. By Mrs. Henry Clarke. Illustrated by G. Demain Hammond, R.I. This is the love story of Kathy Fairclough and Ronald Hammersley. True and good themselves, their fortunes are darkened by the fraud of another. But the shadow passes, and they wed happily. The fraud is discovered, and the deceiver dies, apparently of shock and anxiety. There is something tragic in the story, in spite of the marriage bells with which it concludes.

With the British Legion: A Story of the Carlist Wars. By G. A. Henty. Illustrated by Wal Paget. Yet another excellent historical tale from Mr. Henty's fertile pen: another tale to thrill the imagination and widen the knowledge of British boys. Arthur, the hero, joins the legion which was raised by Sir de Lacy Evans to assist Queen Christina and her infant daughter Queen Isabella (grandmother of the present King of Spain) in resisting the claims of Don Carlos. The story from first to last teems with adventures of the most exciting kind.

In the Hands of the Cave-Dwellers. By G. A. Henty. Illustrated by W. Miller. This story gives an interesting account of the cave-dwellers, Indians who inhabit the lofty cliffs of the Colorado Chiquita River. In the rescue of the white girl, Clara, from them the excitement of the tale culminates, but the whole narrative teems with incident and with curious phases of Mexican life.

In the Great White Land. By Dr. Gordon Stables, R.N. Illustrated by Ambrose de Walton. This is a wonderful tale of the Antarctic regions. A map is given, and much valuable information as to the flora and fauna of the South is given incidentally. The plot of the story is not complicated, yet it has a touch of tragedy. The "get up" of the book is very satisfactory.

With Kitchener in the Soudan: A Story of Atbara and Omdurman. By G. A. Henty. Illustrated by William Rainey, R.I. Three maps. This book is a really valuable addition to the boys' book world, and from a historical point of view well worth the reading of many adults. The story is romantic and full of interest. The hero, Gregory Hilliard, is the son of English parents who settled in Alexandria shortly before Arabi's revolt. He is carefully instructed in the native languages, and before he is twenty obtains an appointment under Kitchener as interpreter. He goes up the Nile with our forces, undergoes many dangers, and greatly distinguishes himself. After Omdurman he obtains from a native a pocket-book that belonged to his father, of whom no news had ever been received since the defeat of Hicks Pasha, many years before. From this pocket-book Gregory learns that his real name is Hilliard-Hartly, that he belongs to the Langdale family, and through the death of an uncle has inherited the marquisate.

"The Fairclough Family." (Blackie and Son.)

Under the Spangled Banner: A Tale of the Spanish-American War. By Captain F. S. Brereton, R.A.M.C. Illustrated by Paul Hardy. This tale is full of thrilling incident and interesting information. Hal Marchant, a young English engineer, is suddenly thrown on his own resources, and decides to work his way out to America as "greaser" on board the *Mohican*, a passenger steamer bound to New York. A terrible storm overtakes the ship, and damages her engines. The engineers on duty are killed, and Hal rushes into the engine-room and shuts off steam at the risk of his life. His courage wins the admiration of all on board, and in particular of a Cuban planter, who offers him a post on his plantation. Hal accepts, and reaches Cuba just in time to witness the blowing up of the *Maine*. Here, again, he upholds the British reputation in excellent fashion. Later he fights for Cuba, and after many adventures marries the beautiful daughter of the Cuban planter. Hal is a lad to make an English boy's heart glow with pride. The account of Cuba and the causes of the war raise the story in part to the dignity of history.

One of the Fighting Scouts: A Tale of Guerilla

Warfare in South Africa. By Captain F. S. Brereton, R.A.M.C. Illustrated by Stanley L. Wood. This story, which numbers De Wet and Botha among its characters, cannot fail to be a welcome gift-book to all young people. The map and excellent illustrations increase the vividness of the tale, while the marvellous courage and coolness of the scout hero will delight every English reader.

CASSELL AND CO.

Little Folks. This is a capital magazine for the little ones, and contains two serial stories, a large number of short stories, poetry, music, and pages for the very little folks, in addition to numerous illustrations. Bright eyes will become brighter still when poring over these pages, and will find plenty of material, intellectual and pleasurable, for leisure moments.

The Ten Travellers, and other Tales in Prose and Verse. By S. H. Hamer. A humorous volume of eighty pages, with four coloured plates and a large number of illustrations. The king of beasts has introduced into his kingdom some proverbs which he has learned from man. Like many humans, the animals fail to grasp the point of many of these, and make complaint to their king, who selects ten of their number, and commands them to disprove the truth of a given set of proverbs. A year's grace is allowed, during which time the selected creatures travel in search of material wherewith to disprove the sayings, and at the end of that period each relates his story. The humour is distinctly good, the illustrations of very great merit, and the whole book most suitable for a Christmas gift.

Bear Cavern. By Edward S. Ellis. In common with most of Mr. Ellis's stories, the scene of this little volume is in America, and introduces us to the breezy outdoor life of farm and village. The heroine is a lovable little girl of eight, and the hero, her brother, a bright, dashing lad of sixteen. The villains of the piece are two tramps, who scheme to carry off the little girl with a view to extort money from her parents. Here we have the material used by Mr. Ellis in the building up of a pretty tale that all young people will like. As would be expected from the author, its tone is altogether unexceptionable, and the attractiveness of the volume is enhanced by half a dozen effective illustrations.

Bashful Fifteen. By L. T. Meade. This is a new edition, with eight pretty coloured plates, of one of Mrs. L. T. Meade's attractive stories. It is a tale of school life in a fashionable seaside academy, and well portrays the varied characters of the young lady pupils, who appear to have much the same likes and dislikes, ambitions and heart-burnings, as the grown-up world outside. The heroine of the story is an almost incorrigible, and entirely home-spoiled, yet withal charming Irish maiden of fifteen. The adventures of herself and her companions, both at school and in the home of the hearty and hospitable squire, her father, in Ireland, are full of incident of just the kind to interest any young girl readers fortunate enough to become the possessors of this distinctly pretty story.

"Under the Spangled Banner." (Blackie and Son.)—*See p. 286.*

W. AND R. CHAMBERS.

A Plucky Girl. By May Baldwin. The heroine of this book, Eleanor Lestrange, generally known as Miss Nell, gives her sister, a clergyman's wife, much assistance in a country parish; and when her sister dies, acts as a mother to the children left behind. To do this she has to sacrifice her own happiness. Her life at the vicarage is not by any means an easy one; and when, after her mother's death and the vicar's remarriage, she is nearly alone in the world, it is but fair to her that her lover should return, and the tale end with wedding bells.

The story is brightly told, and the picture of village life skilfully delineated.

Jack and Black. By Andrew Home. If exciting adventure were the sole necessity in a good book, the one before us would amply fulfil the condition; but as we also expect some amount of probability, it does not.

"Grit and Go." (W. and R. Chambers.)

The hero, Jack Holwell, unfortunately injures another boy in a football match, and leaves the school with the idea he has killed him. Why his guardian does not find out the facts of the case we do not know (for the lad ultimately recovers); but if he had acted as any sensible man would, there would have been no tale to tell. Jack goes to another school, fancies he is followed by a detective, and runs away with another boy whose conduct is inexplicable. After a series of utterly impossible adventures, the original mistake is, of course, cleared up. Perhaps the book is intended as a warning to boys what *not* to do; if so, it is very successful.

Grit and Go. Stories told by G. A. Henty, Guy Boothby, D. Christie Murray, H. A. Bryden, D. L. Johnstone, Harold Bindloss, F. R. O'Neill, and S. Annesley. In striking binding, and illustrated with eight extremely clever drawings by W. Rainey, this volume brings a budget of stories told by some of the most capable writers of the time. Mr. Henty's contribution is a tale of the sea, and of a commercial intrigue which led to incidents of a sufficiently tragical character. Love, jealousy, revenge, and adventures in South Africa are the chief elements in Mr. Boothby's yarn; and in an excellent story by D. Christie Murray, "The Silver Lever," the reader is once again joining in the search for buried treasure with the aid of a chart. This time the chart is scratched on the back of a watch. South Africa, long before the recent Boer War, is the scene of Mr. Bryden's narrative; and then Mr. Johnstone whirls us away to the great Orinoco forest, where we are in the midst of adventures that are combined with love affairs of thrilling moment. Next we are in Canada; then taking part in the Boer War; after that comes another sea story; and a most interesting volume concludes with the history of Captain Phipps's discovery of treasure trove. Generally the book is well printed, but we have noticed "protentous" for "portentous" on page 396.

Stan Lynn: A Boy's Adventures in China. By George Manville Fenn. Dramatically told, chiefly by the aid of conversations, this story is certain to be popular with boys. It is full of incident—the explosion of revolvers, the gleam of swords and knives, and hand-to-hand struggles with Chinese river pirates. The text is excellently illustrated with eight drawings by W. H. C. Groome, and altogether this is one of the most attractive prize books of the season.

The Squire's Little Girl. By L. T. Meade. A particularly bright story, concerned chiefly with the struggle of a "Tom-boy" with her governess. The book has no dull pages, and Mr. A. C. Small has contributed a very appropriate frontispiece.

Lassie and Laddie. A Story for Little Lads and Lassies. By Mary D. Brine. Young folk will thoroughly enjoy this entertaining narrative, though, as it is an American story, some of the terms will need explanation. There are more than a dozen illustrations. Occasionally in the text there are lapses from good English; for even if the following two examples would pass muster in America, where the book seems to have been written, they should have been amended when the story was published in this country. "Never had the sun shone just in that goldenly way" is one example, and the other is, "and was a full-fledged seven-year-older at last."

Dorothy Dot. By E. W. Timlow. Dorothy Dot is a charmingly sweet little creature, who spends a whole year's holiday with her grandmamma in the country. Her pretty ways will have a fascination for most young children, and many a useful lesson will be learnt from her ready obedience and her attempts to please every one who has charge of her at any time. The story is American in theatre, habits, and language; but it is none the less welcome in this country. The six illustrations are very suitable to the story. They are the work of H. Roosevelt Richards.

"Mrs. Wiggs of the Cabbage Patch." (Hodder and Stoughton.)—*See p. 291.*

Miss Bouverie. By Mrs. Molesworth. When a young lady is the heiress to a large fortune, which ought properly to belong to a handsome soldier cousin who will not take it, there is apparently but one solution to the problem, which will occur to every one. Miss Bouverie is in love with her cousin, and he with her, but his pride and the good-natured interference of a relative produce the proper degree of misunderstanding between them—a misunderstanding increased by the presence of a good-looking young Frenchman. However, after playing at cross-purposes for some time, all difficulties are removed. The Frenchman marries a girl to whom he has been secretly engaged without his stern grandmother's consent, and the soldier cousin properly sinks his pride and takes Miss Bouverie and her fortune. The story is well told, and will prove attractive to many girl readers.

The Rebel of the School. By Mrs. L. T. Meade. For amusement, instruction, and inculcation of a healthy tone in the characters of our older girls, we could desire no better reading than that of this book. It is delightful from beginning to end. The heroine is Kathleen O'Hara. She is sent from the wilds of Ireland to be educated in an English school. She brings with her the freedom of an Irish life, uses it in her school, and by her madcap unconventional ways nearly brings ruin on the scholars who had joined her "Wild Irish Girls' Society." Everything, however, ends well. The characters in the story became prosperous, and all admitted that Kathleen's influence was the cause of their success.

Logan the Mingo: A Story of the Frontier. By Edward S. Ellis. This is a book that will be read by boys with avidity. It treats of the struggles which took place between white men and the Red Indians of North America, particularly at the time when the French wanted complete control over the country. Logan is a friendly Indian, and the way in which he helped an English family to escape from the intrigues and subtleties of the Nippinocks makes an interesting story. The description of a flight through woods that were infested with Indians is thrilling and captivating. In fact, the whole book is brimful of interesting exploits and exciting incidents. Interwoven in the story are adventures with wild beasts, which cannot fail to give delight. Running through the story is a continuous lesson on observation, which ought to inculcate the cultivation of that desirable faculty in the boys of our own country.

(From Messrs. Griffith, Farran, Browne, and Co.'s Gift-Books.)

MESSRS. GAY AND BIRD.

The Diary of a Goose Girl, by Kate Douglas Wiggin, illustrated by Claude A. Shepperson, is the diary of a young lady who in very independent fashion quits the hydropathic establishment at which she has been residing for some time, and takes lodgings at a farm-house, or rather tries to do so, but is obliged to consent to enter the house as "a paying guest." She becomes very friendly with the daughter of the house, shares her labours in the poultry-yard, and devotes herself wholly to country pursuits, which are chronicled with much drollery and spirit.

The eccentricities of the farmer and his wife are humorously described. The anecdotes of the muscovy drake and the black hen and kittens are so delightful that one can only hope that they are authentic. The book is pleasant reading for an idle hour, and flashes here and there with wit and something like poetry. Witness the description of the morning song of the thrush: "And there is always the liquid pipe of the thrush, who must quaff a fairy goblet of dew between his songs, I should think, so fresh and eternally young is his note."

MESSRS. GINN AND CO.

School of the Woods. By William J. Long. We have, on previous occasions, had much pleasure in recommending Mr. Long's works to British readers, and the latest of his works materially increases our admiration. The author is a naturalist of the very first class, keen and quick to observe, patient and untiring in his attempts to solve some problem connected with the woodfolk, and also a writer of fascinating prose. We read the book

under consideration with the keenest enjoyment, the only regret being that it was not twice as long.

The main object of the chapters is to teach us how animals educate their young; for Mr. Long contends that what is often ascribed to instinct is nothing of the kind, but merely the result of careful mother teaching, and certainly his observations seem to prove the contention. The last two chapters, on "The Gladsome Life" and "How Animals Die," are intensely interesting. The author proves pretty conclusively that the life of animals is full of pleasure, and that death when it comes is practically painless—a mere sinking to sleep. It is certainly a new idea to us that a fox or a stag enjoys being hunted; but after reading what Mr. Long has to say, it does not seem at all improbable. The illustrations are excellent, and the printing and binding do our transatlantic cousins great credit. If any boy cannot get interested in this book, he is hopeless.

GRIFFITH, FARRAN, BROWNE, AND CO.

A Secret of Berry Pomeroy. By Fred Whishaw. This is a distinctly readable, well-constructed, and absorbing romance by a well-known writer. The story, the scene of which is laid in the beautiful sunny county of Devon, deals with the old castle of Berry Pomeroy, and with the adventures of the smugglers who frequent the underground passages and hidden ways of the castle. It will be seen that here is sufficient material to hand from which all kinds of hairbreadth escapes may spring, and the reader who expects such to be the case will not be disappointed.

The characters are well drawn, though one misses some small amount of humour, which would render the book as a whole additionally attractive.

The illustrations, by Frank Feller, are admirable, and the binding and letterpress are both good.

The Castaways: An Ocean Romance. By Harry Collingwood. This is a new edition, and is best described as a tale of thrilling and exciting adventures, which, starting with the saving of a shipwrecked crew by the valour of the hero, is followed by the unfortunate loss of the ship—all hands, with the exception of the hero and heroine, being lost. Fortunately they find the quarter-boat of the sunken vessel, and after still more exciting adventures discover a derelict ship, which they appropriate, and in addition manage to share their good fortune with the crew of a sunken ship whom they find floating in a long-boat and almost starved. Strange to say, these rescued men show incredible and unheard-of ingratitude, and we have graphic accounts of the horrors of mutiny, piracy, and finally shipwreck. Stern justice is meted out to the few who remain, and who reap in full the harvest of their misdeeds. The illustrations, by Percy F. S. Spence, are excellent, and the same description applies both to the letterpress and the binding.

A Pirate of the Caribbees. By Harry Collingwood. This is another stirring and exciting nautical tale by the author of *The Castaways*, written on the same lines, leaving nothing to be desired in the way of sea-fights, shipwrecks, kidnapping, etc., and describing the bravery and endurance of the hero.

There is no doubt that the writer is in a fair way to become a great favourite with the young people, for these books are decidedly calculated to attract, excite, and absorb the youthful mind, at the same time giving a great amount of good sound instruction in seafaring matters which may prove very useful.

LANCELOT & THE DWARF.

(From Messrs. Longmans, Green, and Co.'s Gift-Books.)

The illustrations, by C. J. de Lacy, are all that can be desired, and the letterpress and binding both good.

GALL AND INGLIS.

The Severing Sword. By J. F. Vallings. Illustrated by John Menzies. A tale of the New Forest and Hampshire in the Civil War. This is the story of

two brothers, Ralph and Marmaduke Compton, who take different sides in the contest, and whose lives are further complicated by both falling in love with the same maiden. Nevertheless, their affection for each other is equal to the double strain. Marmaduke, the younger brother, serves the king at a time when his fortune is waning, and has many terrible adventures while carrying messages to and from Charles. The siege of Basing House and the battle of Cheriton are important episodes in the story.

The Hut on the Island. The story of a week's holiday. By Mrs. Fred Reynolds. Illustrated by Richard Tod. This is a quaint story, prettily pictured,

(From Messrs. Macmillan and Co.'s Gift-Books.)

and charmingly bound. The four children who make holiday together pass six days on the island without, curious to relate, any visits from their natural guardians. How the youngsters passed their time the story itself must tell. The tale, if wildly improbable, is certainly novel and amusing.

HODDER AND STOUGHTON.

In Life's School. By David Watson. A book ostensibly written for young men. Mr. Watson writes in a clear and thoughtful manner on life and its object, and we can heartily commend his book to all men, whether young or old. He shows that character formation is the great and real education, and this must be based upon religion. He introduces no startling theories or scathing denunciations, yet in simple and homely language tries to show that life is but the prelude to that "more abundant life beyond." Quoting Flammarion, the great French astronomer—"The existence of the soul is not to be doubted, and it survives the dissolution of the body"—he shows that science and religion are no antagonistic, but, on the contrary, go hand in hand. Especially interesting is the last chapter, "On Leaving School and After," or, we might tersely say, on life after death. The book is written with an earnest purpose, and we wish it a wide distribution.

Mrs. Wiggs of the Cabbage Patch. By Alice C. Hegan. Evidently written from a real and deep experience of American slum life, this book shows the glaring anomaly of our modern civilization—the unbounded wealth and luxury on the one hand, and unmitigated poverty, heroically borne, on the other. Charles Dickens gave us Mark Tapley; Alice Hegan gives us Mrs. Wiggs. Let many readers make her acquaintance. Pathos and humour, tears and laughter, are intermingled as we read the philosophy of Mrs. Wiggs. A widow with half a dozen children, and with nothing to rear them on, Mrs. Wiggs always presents a brave front and a Christian spirit. Jimmy's death is a most pathetic incident. The love story of Miss Lucy, the Christmas Lady, and Mr. Bob Redding is unwittingly consummated through the agency of the Wiggs family. Reluctantly we part from Mrs. Wiggs, with the promise of a rare welcome if Alice Hegan will help us to renew our acquaintance with her. There are six full-page illustrations by Harold Copping.

LONGMANS, GREEN, AND CO.

The Book of Romance. By Andrew Lang. Having pretty well exhausted the realm of fairy stories in six different coloured volumes, and having brought out three "story books" on animals, etc., Mr. Lang this year presents us with a delightful volume in which he sets out for modern readers some of the more celebrated romances of the Middle Ages. About one-half of the book is taken up with the Arthurian romances based upon Malory's *Morte d'Arthur*. In spite of popular editions of Malory's work and of Tennyson's beautiful *Idylls of the King*, the Arthurian romances are not nearly so well known as they deserve to be, and we heartily welcome this setting of them. Next we have, under the title of *The Battle of Roncesvalles*, a version of the celebrated *Chanson de Roland*, a legend of feudal times, of which translations and imitations appeared in almost all European countries, the movement reaching its climax in Ariosto's *Orlando Furioso*. This is followed by the Irish romance of *Diarmid*, and *Some Adventures of William Short Nose*, *Wayland the Smith*, *Robin Hood*, and the story of *Grettir the Strong*. Robin Hood's adventures form such a thoroughly English romance, that we are delighted to see them wake up after so many years of almost absolute neglect and take a place in this volume. While we give Mr. Lang credit for his excellent choice of material, we must also praise Mrs. Lang for the delightful way in which the stories are written; and

we can hardly speak too highly of the way in which the book is got up, not only as regards printing and artistic binding, but also as regards the numerous illustrations (eight of which are coloured), which so effectively reflect the mysticism of the romances.

MACMILLAN AND CO.

The Prize Library. This splendid collection of interesting standard works has recently been enriched by four volumes the appearance of which will be hailed as opportune by those who are seeking for prize-books or Christmas gifts.

Unknown to History. By C. M. Yonge. The popularity of this historical tale is attested by the fact that it has been reprinted no fewer than sixteen times. A peculiar interest attaches to the life of Mary, Queen of Scots. She lived in a time of strong party feeling, and her troubles and sad end move our sympathy, however much we may be disposed to condemn some of her acts. Miss Yonge in writing this story has skilfully made use of the historical setting, and avoided the rigid historical facts.

Agatha's Husband. By the author of *John Halifax, Gentleman*. This interesting story is so well known that it needs no description. We certainly regard it as one of the authoress's best novels. This edition marks the fiftieth anniversary of its original publication, and is illustrated by no less an artist than Walter Crane.

Pride and Prejudice. By Jane Austen. This masterpiece of Miss Austen is presented to readers in a very attractive guise, well bound, beautifully printed, with an introduction by Austin Dobson, and illustrations by Charles E. Brock. To those who have not yet made the acquaintance of the characters in this book we recommend this edition cordially.

(From Messrs. Macmillan and Co.'s Gift-Books.)

Emma. By Jane Austen. This is another well-known novel which the publishers are offering in a popular form. But like the other volumes of the series, it is extremely well got up, and the illustrations forty in number by Hugh Thomson, are masterpieces of the draughtsman's art. In these days of illustration by process blocks, it is quite a treat to study such splendid line drawings as those with which this volume is illustrated, and to think what a vast amount of character, what a fund of humour, a skilful artist can set out with a few lines.

A Year with the Birds. By W. Warde Fowler. This book, by a well-known lover of birds, will be welcomed by all who are interested in the songsters of the air, and those who have not previously paid much attention to them will be attracted to this charming study on reading this book. The writer records, in a simple yet fascinating manner, his own observations on bird life. The observations were made in three localities—at Oxford, at a Midland village, and in Switzerland. With the part dealing with Switzerland we were particularly pleased; and although, in passing over the same ground as the writer, we had come to the conclusion that Switzerland is very badly off for birds, we see that careful observation shows that variety partly makes up for deficiency in numbers, and we hope to increase the enjoyment of future visits by observing the birds and their interesting habits.

The Other Boy. By Evelyn Sharp. This story is sure to delight not only the children, but those who are interested in them. The title is drawn from Tony, "the other boy," who comes with his governess into the family of an artist who already has three girls and a boy. The life of the children is well described, especially in its relation to the visit of Aunt Theodosia, who has very strong ideas of her own about the education of children. The children even conspire to get her to shorten her visit; but in the end the course of child-study through which the aunt goes produces a great change in her, and she becomes quite the friend and playmate of the children.

The New Pupil. By Raymond Jacberns. This is a tale of a small school for girls. The number of pupils is increased to thirteen by the arrival of "the new pupil," Pollie, from Italy. She has never been to school before, and the difficulties she experiences in settling down are told in a very interesting way. In fact, some may consider it rather too realistic; for although a certain amount of slang may be indulged in among schoolgirls, we doubt the propriety of printing it in a book for girls. The lively character of Pollie is well contrasted with the quiet, gentle character of her friend Elsie. The illustrations have great charm and finish.

The Vicar of Wakefield. By Oliver Goldsmith. This is a reprint of the edition illustrated by Hugh Thomson, at a lower price, but with practically all the excellences of the original 1890 edition. The illustrations number 182, and they are a wonderful aid to the realisation of the story itself. The edition forms an admirable Christmas present.

ANDREW MELROSE AND CO.

Boys of Our Empire. An illustrated magazine for boys all over the world. A very worthy attempt has been made to carry out the idea set forth in the sub-title; and although much remains to be done before a world-wide constituency of readers is secured, the present volume will prove very helpful in bringing about the desired result. There is a collection of short stories, six serial stories, numerous miscellaneous articles, and a series of short sketches, entitled

"Champions of the Week," dealing with people of note in various spheres of activity, which should prove very instructive and entertaining.

The Girls' Empire, by the same publishers, is on similar lines to the above, and contains, among other interesting matter, articles on "Girls' Pets, and how to manage them," "Athletics for Girls," "Cosy Corner Chats," and a course of exercises, entitled "How to be Strong," which will prove very interesting to any girl who is fortunate enough to secure a copy.

METHUEN AND CO.

The Visit to London. Pictures by Francis D. Bedford, and verses by Edward V. Lucas. Theodore—T—and Dorrie are invited to London by their cousin Winnie. Under the protection of Winnie's papa, the three little cousins pay visits to all the interesting sights of London. Much useful information is thus culled, and told in simple verse, and illustrated by some very clever coloured pictures, which are real works of art. An excellent prize or gift book for young children.

NATIONAL SOCIETY.

Conan the Wonder-worker. By Mary H. Debenham. This is a thoroughly good boys' book, for from the first chapter, with its exciting fight between the vessel of the sea-king Halfdan and the Saxon merchantman *Eagle*, the interest is maintained without flagging right to the close of the story. But apart from the interest of the story, the book is to be recommended for its vivid pictures of the Norseman, showing his habits and mode of life, and also for the religious manliness of its tone.

"CONAN THE WONDER-WORKER." (National Society.)

A True Knight. By Lady Dunboyne. This romantic little story is adapted to our elder boys and girls, on whom the characters depicted must insensibly exert a good influence. The loss of fortune by rash speculation on the part of Squire Mansfield brings out the sterling worth of his two children, and also reveals the weakness of his niece Greta. The trouble caused by the deviation of the latter from the paths of rectitude, and the efforts of Rex, "the true knight," to defend her from the consequences of her own misdeed, will be followed with great interest by young readers, whose sympathies are bound to go out to Rex when, having found that Greta has really committed the theft, he goes out to play his part in the late South African campaign.

Judith's Mission. This bright little story of what a girl can do will not fail to win the admiration of our young readers. Judith was the daughter of a clergyman, and her mission was to bridge over the gulf that existed between the household at the vicarage and a wealthy great-aunt. How the aunt, who at first suspected Judith's motive, was brought to play her part in God's great plan, we must leave the book to tell.

Foundations. By Mrs. Walter Ward. The style of this book is decidedly original; there is very little incident, the aim being rather to show the development of character. The various members of the Core family have been faithfully delineated, and one follows with interest the growth—moral and physical—of Stella, the youngest daughter. The plot is, however, so slight that we are afraid that young readers will find it difficult to sustain their interest, especially through the long digression caused by the introduction of Luke and Hannah.

Mistress Dorothy. By Dorothea Moore. A very pretty little tale, throwing a side-light on Monmouth's rebellion and the defeat of Sedgemoor. How Mistress Dorothy helps her brother, who has been captured by "Kirke's Lambs," by braving the terrible Colonel Kirke himself, is told in a charming and skilful manner.

Darius Drake, and Other Stories. By Katherine Vernham. In this collection of short stories the writer has shown considerable skill in depicting scenes in humble life, but we doubt the wisdom of obtaining realism at the expense of grammar in a book intended for young readers.

T. NELSON AND SONS.

A Fortune from the Sky. By Skelton Kuppord. Those of our readers who know this author's earlier work, *The Uncharted Island*, with its wonderful sea-yarns and marvellous search for lost treasure, will be

prepared to find thrilling adventures and distinctly unusual experiences in the book now under review. They will not be disappointed, though in the present story the "treasure," so to speak, is found in the sky, and, curiously enough, is sought after more by those who provide the fortune than by those who win it.

But the fortune in this story is only a means to an end, and not the end itself. It is the realisation of that end which introduces us to an absorbing series of extraordinary adventures and sensational incidents, brought about by what may be termed the science of the future.

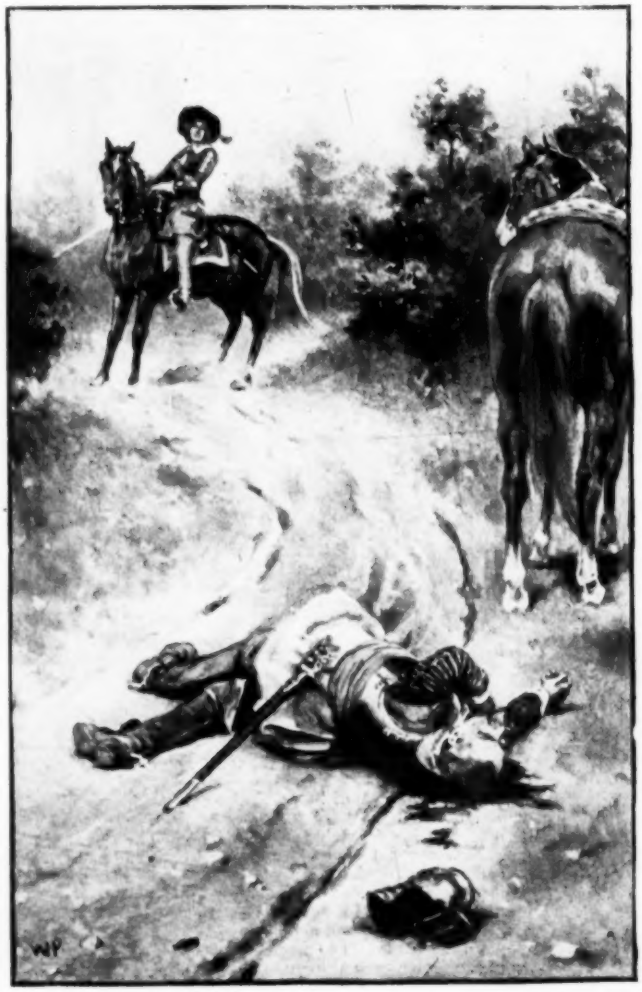
The story opens at a time (may it be far distant) when this country is on the eve of war against the allied forces of France and Russia. Indeed, it is reported in Fleet Street that an ultimatum has reached our government. A young countryman in London, at his wits' end to get a living, sees in the approaching hostilities a chance of escaping from his difficulties by enlisting. While at a loss in the meantime where to get a night's lodging, the question is decided for him by a strange adventure in the streets, which unexpectedly procures for him accommodation at a police station. It is this event which introduces us to the two leading figures, or magicians, of the story, and to the weird, almost uncanny results of their scientific attainments, which entirely revolutionise the art of war, giving—as it should be the supreme arbitrament of all international disputes into the hands of the British, and putting the country, indeed, in the possession of a death-dealing machine which apparently might be made to sweep off almost the entire population of the globe in the course of a day or two!

The events leading up to the perfection of this machine, and some of the dire results of setting it in operation, are striking indeed. There is no lack of interest in any of the pages of the book. It is well written, and all readers on the lookout for a new literary sensation should not fail to procure it.

The Last of the Cliffords. By Eliza Pollard. We can strongly recommend this book as one that will form a beautiful present for the older scholars. It is a historical tale dealing with the civil war in the reign of Charles I. The central figure is the Lady Anne Clifford, who, taking the king's side at the outbreak of the war, bravely holds out in her castle for three years against the enemy. All the characters in the book are splendidly drawn, but that of Lady Anne calls forth our greatest admiration, and the hardships which she and her retainers undergo during the siege arouse all our sympathy. We also follow the fortunes of John Linton, Lady Anne's ward, who first comes on the scene as a nameless baby; then as a boy of ten he goes abroad, and while there makes the acquaintance of Prince Rupert. Later on, at the outbreak of the war, when Charles has need of all his friends, John and Rupert return to England and join his army. From this point the progress of the war is described in such a readable style, that we follow to the end of the book with the keenest interest.

Sale's Sharpshooters. By Harold Avery. This book is not a thrilling account of adventures and escapes in the South African War, as its name might suggest, but an amusing story of an amateur volunteer corps formed by three little boys, with a girl for the army medical corps. The sensational part deals with the precious stones of the "Major" next door, whose greenhouse had been used as headquarters. The writer is well known for his schoolboy stories, and this book will add another to his list of successes. The humour of the book is just the sort to delight the schoolboy reader, for whom it is intended.

A Happy Failure. By Ethel Dawson. When the story opens, fortune has been dealing heavily with the family of Mr. John Lenthall, who lost his all in a



"The Last of the Cliffords." (T. Nelson and Sons.)

"THE LAST IN" (WILLIAM MULREADY, R.A.).

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bank failure, and shortly afterwards died. His three daughters decide to take a boarding-house, and by hard work to maintain themselves in independence. The account of their trials and difficulties makes a very interesting book, in which the lesson of duty is inculcated but not obtruded. We can recommend it as a most acceptable present for a girl. The publishers have produced the book in a very tasteful style. The illustrations are particularly good.

Fallen Fortunes. By E. Everett-Green. Miss Everett-Green has already made a name for herself as a writer of story books with a historical basis, and this story of the reign of Queen Anne will do much to increase her reputation. Not only is the story well developed and full of incident, but the style is remarkably lucid and impressive. The tale is such that it is impossible to indicate its line of action in the short space at our disposal, but we were particularly impressed with the description of the battle of Ramillies, in which the hero, Grey Dumaresq, saves the life of the Duke of Marlborough; with the painting of court life and the manners of the time; and with the account of the attempts of the hero, who has been cheated of his estates, to earn an honest living away from the vanities of the court, and to prove himself worthy of the fair Lady Geraldine Adair, a lady whose tastes are very similar to his own. The book is sure to meet with a warm welcome from all who have the good fortune to read it.

"Fallen Fortunes." (T. Nelson and Sons.)

Stanhope. By E. L. Haverfield. A tale of the days of Cromwell. Miles Courtney and Sir Lionel Stanhope, the wards of Mr. John Stanhope, at the outbreak of the Civil War favour different sides, and the tale follows chiefly the fortunes of Miles Courtney. In his endeavours to raise men for the Parliamentary cause Courtney becomes acquainted with a Puritan family, the daughters of which, Hope and Mara, form the heroines of the love parts of the story. The characters of these two sisters, so widely different, are finely drawn.

The loss of Sir Lionel's sister, who is discovered after many years, keeps up the interest of the tale right to the end. The plot is well arranged, and we are obliged to read right to the end before we can guess the secret which had caused such a shadow over the home of the Puritan family. The local colour given to the tale carries the reader forcibly back to the times of the Civil War, and makes the book a most suitable gift for older children and adults. The publishers have spared nothing in the way of binding and illustration to make the book tasty.

At the Point of the Sword. By Herbert Hayens. Tales of war always seem to interest boys, and this will certainly prove no exception to the rule. The action is laid in the war of Peruvian independence, which gives a freshness to the tale; while the fact that the hero is of British origin enlists the sympathy of the British boy in a way that would have been impossible had a South American patriot been the principal character. We will not take from the interest of the story by giving an outline of it, but can strongly recommend the book as a prize or present.

The Cruise of the "Katherina." By John A. Higginson. This is a book of very thrilling interest for boys. The *Katherina* is fitted out by two men with the object of recovering some treasure concealed on an island in the Pacific by one of them and a partner who was afterwards murdered. After escaping a terrible volcanic disturbance, they come across the murderer, whom they track for some time till he is drowned. The writer is a man who has spent many years on the sea, and writes a sea story in a way that no landsman can.

In Flora's Realm. By Edward Step. The story in this book is of the simplest character, and is, in fact, only a framework on which to fix descriptions of flowers, fruits, and leaves. Every child who loves flowers—and what child does not?—will enjoy

reading the account of the delightful talks between Flora and her uncle, and will at the same time acquire a large amount of general but accurate botanical information without the tedium that attaches to a text-book. The illustrations are really beautiful. They number more than a hundred, and include some very fine specimens of colour-work. In other respects, too, the book is very artistically got up.

GEORGE NEWNES, LTD.

From Cradle to Crown. By J. E. Vincent. This is the alliterative title of a biography of his most gracious Majesty King Edward VII. And we might say the volume is worthy of its subject, for it is a right regal production in all respects. It is a large book, 13" × 10¼", strongly and tastefully bound in cloth, richly gilt, bevelled boards, and profusely illustrated. Indeed, we can hardly speak too highly of the illustrations, which are all in black and white, chiefly from photos and pictures in the royal keeping. It is a real feast of pictorial education included in 336 pages. Mr. Vincent is the author of *A Memoir of H.R.H. the Duke of Clarence and Avondale*. And as the present volume is also written by authority, it is evident that all official sources of information have been at his command. Hence the absolute reliability of the text.

S. W. PARTRIDGE AND CO.

Cap'n Nat's Treasure: A Tale of Old Liverpool. By Robert Leighton. This tale is full of adventures for the recovery of treasure which was sunk in one of the Liverpool docks, and which was recovered and stolen. It portrays the time of the slave-traffic in England, and gives an account of the sale by auction of a slave by the old custom of a burning candle. Boys will be greatly interested in this story, and there are eight beautiful illustrations by J. B. Greene.

One of the Tenth: A Tale of the Royal Hussars. By William Johnson. This book endeavours to present the life of a soldier in its true colours, giving the hardships suffered in the field, scenes round the camp-fire, and life in barracks. The hero joins the Tenth (Prince of Wales' Own) Royal Hussars as a trooper, and takes part in the Afghan War. He is promoted to the position of a sergeant, and afterwards returns to England, and he assists in rescuing entombed miners. The book is dedicated to Lord Ralph D. Kerr, whose bright and cheery smile and kind words saved many a brave soldier from falling by the way while passing through the Khyber Valley during the death-stricken march to India. There are six fine illustrations by Harry Payne.

Those Berkeley Girls. By Lillias Campbell Davidson. The two heroines in this story expect to come into a fortune, but on their uncle's death they find themselves penniless. Their efforts to establish a tea-shop are very amusing to the reader, though they are far from being so to the two young girls. After many struggles they overcome their difficulties, and they are offered the management of a number of tea-shops which are established in the town by a millionaire, who desires these shops to employ poor girls, and thus realise a philanthropic scheme he wishes to promote. Finally, one of the girls marries the millionaire, and the other becomes the wife of a gentleman whom she has helped to nurse through an illness. The book is profusely illustrated, there being no less than twenty-three engravings.

C. ARTHUR PEARSON, LTD.

The Story of a Scout. By John Finnemore. The Peninsular War is now ancient history, but in this story Mr. Finnemore gives a vivid and thrilling account of some of the operations which led up to the battle of Vittoria, and the consequent expulsion of the French from the country south of the Pyrenees. The "scout" is an English boy who has spent several years upon his father's estate in Spain. Thoroughly British in every way, he is able, nevertheless, to use the native tongue so fluently that he frequently passes as a Spaniard, and in various capacities is able to render valuable service to the army under Lord Wellington. The leading characters are well drawn, and full credit is done to the gallant French.

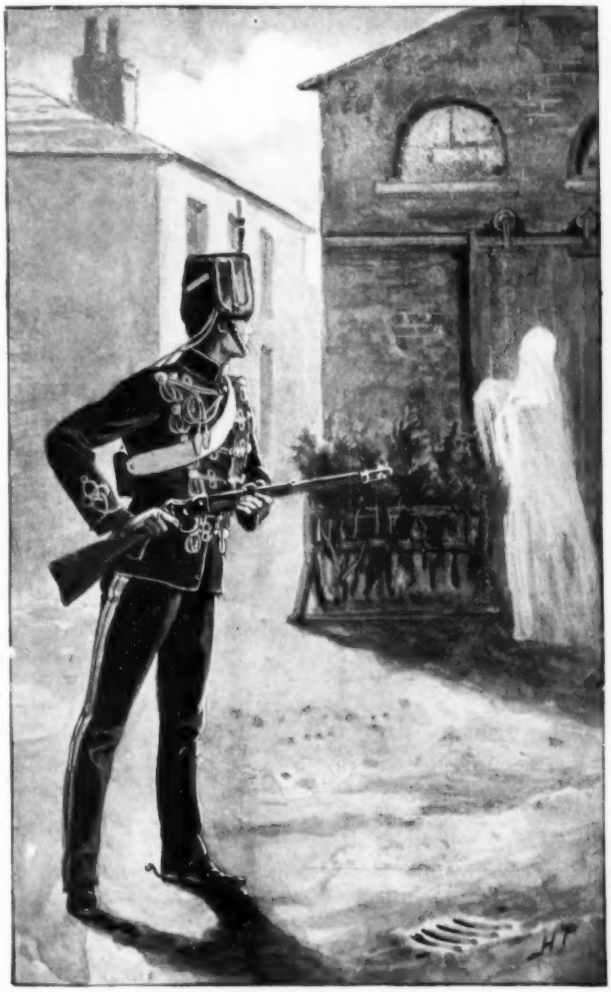
The Boys' Book of Battles. By Herbert Cadett.

(*From George Newnes's Gift-Books.*)

Mr. Cadett captures his reader at the first onset. He writes in a style which is racy without being exaggerated. Seventeen of the stories are descriptive of battles in Africa—North, South, and West: the remaining five tell of the battle of Kandahar, the storming of the Taku forts, the Manipur Revolt, the storming of the heights of Dargai, and the siege of the Peking Legations. In the matter of "loot" the colour scheme of Mr. Cadett's logic seems to us to be defective, for he appears to consider that two blacks make a white. However, as he is intensely British, and vastly entertaining to boot, he may be forgiven. The "Well done, *Condor*," incident is told in picturesque, not to

say piquant, language. It is the first time we have read that Lord Charles Beresford considered the *Condor* capable of making Fort Marabout "stash it." The dash of slang here and there will appeal in a unique fashion to boys old and young, and we are confident that no one of British blood will read these well-told stories without being inspired to serve his country as best he may.

The Romance of Modern Invention. By Archibald Williams. Without in any way pretending to be a text-book, *The Romance of Modern Invention* tells a plain, unvarnished, but withal fascinating, story of some of the more noteworthy achievements of recent years in the realm of applied science. The book covers a wide range of subjects—from "Wireless Telegraphy" to "Photography in Colours," and from "Submarine Boats" to "Mechanical Flight." All the articles are of great practical interest, and are most readable, but the paper on "Liquid Air" will probably attract more readers than any other, for it holds out most hope for the future. Many uses will be found for a power that is at once handy, clean, and portable, especially if Mr. Williams's prophecy comes true that the price will be reduced to a penny per gallon. In his opinion "liquid air" has come to stay. An apt quotation from *Locksley Hall* in the article on "Mechanical Flight" is spoiled by two bad "printers' errors."



(*From S. W. Partridge and Co.'s Gift-Books.*)

Kids of Many Colours. By Grace Duffie Boylan and Ike Morgan. A delightful book for children this, with new nursery rhymes by the dozen and coloured pictures by the score. Of course, "kid" in this connection is not yet a dictionary word, but it ought to be after the publication of this attractive volume. There are lullabies from China and Hawaii, from Lapland and Egypt, and, in fact, from all over the world, to say nothing of a well-selected series of mother songs. The quaintly-drawn pictures are an ethnological education in themselves.

> "The kids of many colours here, straight and kinked and curled,
> Are just the little people that make the little world."

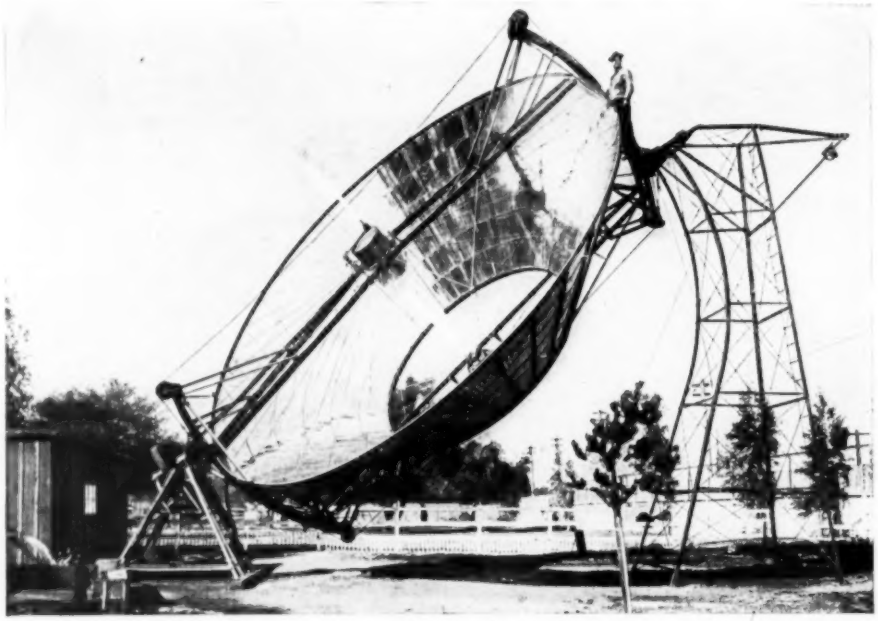
THE RELIGIOUS TRACT SOCIETY.

The Girls' Own Annual for 1902. This handsome volume, the twenty-third of its kind, can be confidently recommended to those who wish to make a valuable present to their girl friends. There are 830 pages, contributed by a host of well-known writers, and splendidly illustrated by equally well known artists. Its contents will be found helpful to girls of all ages, and include many very useful articles concerning girls' employments, household hints, management of the home, etc., all of a thoroughly practical kind. Some of its more serious articles, such as those dealing with "Studies in Character," "Purity," etc., are most inspiring, while its serial and shorter stories will provide reading for many long days. The published price is 8s., and it is well worth the money.

SUNDAY SCHOOL UNION.

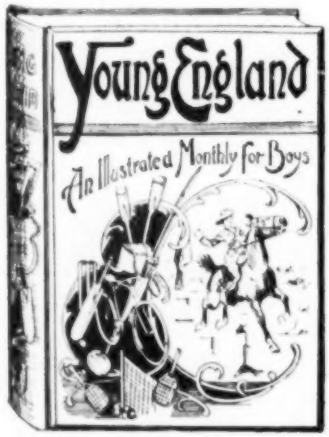
The Child's Own Magazine. That this is the sixty-ninth annual volume is sufficient proof of the popularity of this publication, intended for young readers. The short stories are just the thing for those whose powers of concentration are limited to a fifteen minutes' effort, and are supplemented by a large collection of helpful illustrations. There is a serial story, "Jack's Baby," for the more advanced among the juniors, together with numerous picture puzzles to test their ingenuity. To those who wish to give pleasure to any young friends of from eight to ten years of age we say, "Buy it."

Young England. An illustrated magazine for boys throughout the English-speaking world. This is essentially a boy's book, and a very good one. In its five hundred pages there is enough to satisfy thoroughly the most exacting. Its three serial stories furnish very healthy, exciting reading, and several of the shorter stories are remarkably well told. Its usefulness is



(*From C. Arthur Pearson's Gift-Books.*)

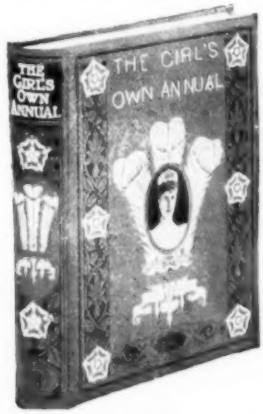
evidenced by the numerous miscellaneous articles, dealing with a variety of subjects, among others, "Cricket Hints," "A Talk about Books," "The Constellations, and how to find them," "Stories of Life at our Public Schools," "The Uganda Railway," "Japan, To-day and



Yesterday," etc.; while to those of a mechanical turn it will appeal on account of its workshop articles, giving the necessary information for making a telephone, bicycle-house, aquarium, etc. The illustrations are numerous and good, and the volume forms a handsome present for boys both old and young.

WARD, LOCK, AND CO.

Tiny and her Grandfather. By E. Everett-Green. For the younger people, especially girls, this story is an interesting one. The sub-title—"a small beauty, and an ogre who was not a beast"—suggests the trend of the book. A little girl, gentle and beautiful, is the means of bringing happiness to an old man's last days.



THE RELIGIOUS TRACT SOCIETY. (*See p. 297.*)

She is also the reconciler of her father to *his* father, who had cast him off. The book is nicely printed and well illustrated.

Bunny. By B. A. Clarke. A very nice story for boys, pleasantly told.

Myself when Young. By Rowland Grey. An autobiography of childhood, told in ten chapters of flowers, with Brother Buff as a constant companion. It is a clever retrospect, in which many of us may

recognise the simple little episodes which constituted childhood's happiness. School life, too, at Cambridge, Rugby, and abroad, with holiday life in the Isle of Wight, contribute incidents in the early life of Rowland Grey. Some illustrations might have brightened the book.

An Account of the Manners and Customs of the Modern Egyptians. Written in Egypt during the years 1833-1835 by Edward William Lane. The works of Edward William Lane, the learned Orientalist, have become standard works upon the subjects to which he devoted a life of study, and this, his book on the modern Egyptians, is one of the most interesting and instructive books that one could read. To present it in this cheap form, there has been some sacrifice in the quality of the paper; but even with the modifications that the low price has made necessary, the book will be welcomed in many of the humbler libraries where good literature must needs appear in other forms than printed on large paper and bound in morocco. The volume includes nearly a hundred illustrations, a biographical notice of the author, and a good index.

Frank Farleigh; or, Scenes from the Life of a Private Pupil. By Frank E. Smedley. The republication of this story will recall to old people a period when many of the narrators who now have the ear of the people were unborn. A large number of the stories published in the same era have fallen by the way, but this one had qualities that preserved it from oblivion. It is an entertaining story, written with much sparkle and cleverness, and even to-day, surrounded by so many competitors, it will not fail to find and to amuse a large number of readers. The insertion of George Cruikshank's illustrations also recalls a distinct and most interesting period in the history of book publication.

Little Mother Meg. By Ethel Turner (Mrs. H. R. Curlewis). In the telling of this story the authoress displays much skill, but for all that the quality of the book is very unequal. There are parts where one tires of the conversations and finds them tedious. The tale is concerned with domestic life, and the periods of pleasures and trials that come and go in the life of families are well presented. The illustrations are excellent.

The World of Ice. By R. M. Ballantyne. As a writer of boys' books Mr. Ballantyne had few equals, and the volume before us is worthy of the writer's high reputation. Fred Ellice's father sets out on a whaling expedition, but as nothing is heard of him or his ship for three years, Fred embarks on the *Dolphin* in order to search for him. Arriving in the Arctic Seas, the *Dolphin* is frozen in; and we get a vivid description of life in the "world of ice" during the winter months, with its dangers and difficulties, its sports and amusements. Besides being entertained with the various adventures, the young reader will incidentally gain much valuable information concerning some of the phenomena connected with high latitudes, while the few earnest words of advice that the writer occasionally introduces cannot fail to bear fruit.

The Nidding Nod. By H. Escott Inman. The child that receives *The Nidding Nod* as a present from Santa Claus will indeed be happy, for the adventures of Patty and Pats with the Muggle Wub and the Sawdust Elephant will afford amusement for many a long evening. Arriving at the land of One-fine-day, Patty and Pats inform King Cole and his captain, Nobbly Bob, that they intend going to the land of Once-upon-a-time, in order to catch the Nidding Nod and put him in a book. Before they accomplish their task they go through many adventures and meet all sorts of delightful people, which are bound to please and amuse the young readers. The numerous illustrations add to the interest of the book.

FOR THE LITTLE ONES.

C. ARTHUR PEARSON.

In Search of the Wallypug. By G. E. Farrow. Illustrated by Alan Wright. This is a handsome fairy gift-book for the little ones, full of quaint pictures and decked in a gaily-gilt binding.

The adventures of Jack and Vera with the Dodo in fairyland will raise many a hearty laugh. They are, however, too many and too varied even to be outlined here; but that Master Jack was a resourceful lad will be made clear by mentioning that when he, Vera, and the Dodo found themselves accidentally imprisoned in the chamber where the electric switches were, he promptly switched *off* the current, arguing wisely that some one would speedily come to switch it on again.

GRIFFITH, FARRAN, BROWNE, AND CO.

The Newberry Toy Books: Feathered Friends, Going to Bed, Old Stories, Rhymes and Jingles, Sheep and Shepherds, Tales for the Nursery. These six enchanting little toy books are specially adapted for attracting and entrancing the wandering fancies of our little folks. The combination of the prose, poetry, and pictures of the nursery rhymes and jingles of the nineteenth century, adorned by the exquisite colours and prints of the present day, cannot fail to please the most fastidious tastes. However, we quickly recognise the fact that little departure can be

MESSRS. WARD, LOCK, AND CO.

made from the old rules for amusing the children if we wish to be welcome guests in the nursery.

MACMILLAN AND CO.

Peterkin. By Mrs. Molesworth. This is a book that will delight the children, especially those who are not too old to enjoy fairy tales. Not that the book is

a fairy tale, but they will be able to sympathise with little Peterkin, who simply revels in these until his favourite characters seem to be real. Thus a parrot in a neighbouring house becomes the "blue bird" of his fairy tale; and a little girl Margaret, an imprisoned princess, whom he imagines to be under the spell of a wicked fairy. The way in which Peterkin and his brother attempt to free her, and the misfortunes that befall them, are told in the most pleasing manner. The children who read this book will certainly close it with regret.

DEAN AND SON.

An A B C of Everyday People. By G. E. Farrow. Illustrated by John Hassall. Each of the seven ages of man has writers who produce books suitable for its own peculiar temperament, but the book before us will afford enjoyment for all. The verses and pictures will appeal to the little ones, while their quaint humour will please the adults.

Old Nursery Rhymes, dug up at the Pyramids. By Stanley L. Adamson. This book does not strike us as a success. The idea is somewhat original—namely, to draw pictures in the Egyptian style to illustrate nursery rhymes. Some of these illustrations are fairly good, but the points appeal to adults only; children cannot be expected to appreciate them, and will certainly be repelled by the sackcloth in which the compilers have had the fancy to bind the book. Even

adults fail to see the humour of this; for it is not an imitation of anything Egyptian, and is very unlike the dainty covers we demand for the books we present to our little ones.

THOMAS NELSON AND SONS.

A specially cheap series of toy books has been prepared by this firm. It comprises **Ride a Cock-Horse, The House that Jack Built, What's o'Clock? Country Cousins, Pick-a-Back,** and **Red Indians.** Each book contains nursery rhymes and jingles, such as children delight in, and is tastefully illustrated with coloured pictures. Many of the ideas developed are extremely original. **Pets' Playtime, Sunny Hours, Fur Coats,** and **Can't You Talk?** are of larger size than the former, and are destined to bring delight into the heart of many a child. The examples of colour printing are splendid, and the last two contain some really charming animal studies. But the palm of excellence among this season's toy books must be awarded to **Mother Hubbard's Cupboard of Nursery Rhymes.** Popular and patriotic songs endure for a season, but nursery rhymes are for all time; if, however, there is a limit to the possibilities in the matter of illustrations for them, it has surely been reached in this edition.

Sunday Afternoon, or the Sweet Stories of Old Retold, and **The Friend of Little Children** can hardly be classed as toy books. The former consists of some of the chief stories from the Old and New Testaments, told in simple language and illustrated with beautiful coloured pictures. The latter is an account of the life of our Lord, written especially for children; hence the earlier parts of the life are treated with special fullness. In this book, too, the illustrations are very fine. Both books are extremely well written, and will make admirable Christmas presents or Sunday-school prizes.

THE CROWNING YEAR

READERS of THE PRACTICAL TEACHER need no introduction to the firm of Messrs. Raphael Tuck and Sons. Year by year we have noticed their art specialities in our columns, and year by year it has been our pleasure to record marked advance in all that relates to their beautiful art productions sent forth at this season of the year. The few specimens submitted this year show that a still higher level of excellence has been attained by this famous house in their output of productions so appropriately described under the title we have quoted as our heading. The preparations made by Messrs. Tuck for the celebration of this Crowning Year have, we are told, been arranged on a scale of completeness and splendour worthy of the occasion. Their new collection of Christmas and New-Year Cards, Calendars and Books, Pictures and Art Novelties, is, as heretofore, of the highest artistic merit. We understand that no less than one thousand five hundred sets of entirely new Christmas and New-Year Cards have been prepared by their best and most experienced artists this year. Of these the greater portion are in colour, and the rest in black and white. Classified in different ranges of style, they embrace every imaginable variety of subject suited to the differing taste of the many.

By the gracious permission also of Her Majesty Queen Alexandra, Messrs. Tuck are enabled to enrich their Christmas Cards proper with a beautiful Christmas panel, representing "St. John and the Lamb"—a delightfully treated subject, specially painted for the first Christmas of the New Reign for Her Majesty, who graciously pronounced it "beautifully executed;" while last season's immensely popular Queen Victoria panel of the "Nativity," by the same talented artist (H. M. Bennett), will have a new lease of life granted it by its introduction this year in boudoir panel size, at the popular price of one shilling.

In addition to the firm's **Celluloid Cards, Boxed Cards, Humorous Cards, Christmas Post Cards,** they announce a variety of **Daily Block Calendars,** as well as a large collection of **Art Calendars.** For the last-mentioned the works of old masters and modern artists have been laid under tribute. The **Toy Books,** too, are of a very pleasing nature, beautifully produced, and well suited to the needs of our little ones. **Father Tuck's Annual** is brimful of all kinds of illustrations—colour, black and white, humorous, and pleasing. Inventiveness, imagination, taste, and skill are in a high degree manifest in all Messrs. Raphael Tuck's splendid productions.

OUR TUTORIAL SECTION

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

Principal of the Belvedere Pupil Teachers' Centre, First on Scholarship List; Author of "Scholarship School Management," "Building of the British Empire," etc.

SCHOLARSHIP EXAMINATION, 1903.
Twelfth Month—December.

Work for the Month.

As the time before the examination will necessarily be employed very largely in revision, we give this month some points which should be specially attended to in connection with the various subjects.

1. *Teaching.*—The questions on the teaching of the various class subjects will occur in the different papers, and in all probability will either be compulsory questions, or questions which carry more marks than others. Those who have carefully prepared the chapters prescribed in *Scholarship School Management*, and have tested their reading by the collection of questions at the end of the book, will have no difficulty in answering anything asked for. A final revision should be made of what is said on the actual methods of teaching, and the section on "How to Write Notes of Lessons" is most important. If you are asked to draw up teaching notes or full notes on anything in grammar or arithmetic, remember that matter and method is not the right arrangement, but that the lesson must be taken in steps. Each is a science, the laws and rules of which are to be ascertained by induction from suitable examples.

Never start a grammar lesson with a definition. In geography and history a careful selection of facts must be made, and as carefully arranged. There are few lessons in geography in which a sketch-map is not necessary, and a plan is essential in giving a lesson on any battle. If the proper arrangement of the lesson is in matter and method, remember that the matter column must contain all you wish to teach, and the method column simply the means by which you teach the facts, the illustrations you would use, etc.

2. *Drawing.*—One or two copies should be done each week against time. The chief points to be attended to have been given several times in the course. Read very carefully the instructions given with the drawing. Small copies are useless. Before commencing to draw, study the copy; find out the leading lines on which it is based, and note carefully the proportion of the parts. Then draw the chief lines in proper proportion. If this is done successfully, most of the difficulty has disappeared. Then fill in the details, and proceed to line in. As it is quite possible that you will not be able to complete the whole copy in the time allowed, you must sketch in as much as possible; and whether you have finished all the detail or not, some part of it must be lined in. Have a sufficient number of pencils ready, that time may not be occupied in sharpening or preparing them. The lines must everywhere be smooth and flowing, and great care must be taken in lining in to get soft and even curves, and not hard, wiry, irregular lines, with every place visible where the pencil has been lifted. Care must also be taken to rub out all unnecessary marks, so that the final copy may stand out clean and clear. The main outlines should be slightly heavier than the details. Veins of leaves should taper from base to point.

3. *Music.*—Practice in the practical part of the examination must not be neglected. Keep cool, do not hurry at the tests, and make quite sure of what you have to do before you start.

The theoretical paper cannot present any difficulty, and no student need lose a single mark. The scope of the examination is very limited, and a few hours' application is sufficient to learn all that is needed. The questions each year run on nearly the same lines. Neatness and clearness in writing the sol-fa notation is most important.

Points to remember:—

(1.) Intervals are major or minor, except in the case of fourths and fifths. The fourths are perfect (five semitones), and pluperfect or tritone (six semitones); fifths, imperfect (six semitones) or perfect (seven semitones). A diatonic interval is the interval between any two notes of the major scale. A chromatic interval may be either augmented (larger than the major diatonic) or diminished (smaller than the minor diatonic).

(2.) The primary form of a measure starts on the first note of the measure; the secondary form on any other note.

(3.) The half of || d :-,d || is || d .,d ||, and *not* || d .-,d ||.

(4.) In the minor mode, the three forms of the upper tetrachord are:—

(1) *Ancient*, ascending, m f s l; descending, l s f m.
(2) *Chromatic*, ascending, m f se l; descending, l se f m.
(3) *Modern*, ascending, m bah se l; descending, l s f m.

There are *two* sixths and *two* sevenths:—

- se, major essential seventh.
- soh, minor occasional seventh.
- bah, major occasional sixth.
- fah, minor essential sixth.

(5.) The bridge notes must always be inserted in transition. The following are typical questions:—

(1) Write a minor or lah scale in the three following forms—
(*a*) Ascending, using minor sixth and major seventh.
(*b*) Ascending, using minor sixth and minor seventh.
(*c*) Ascending, using major sixth and major seventh.

(2) Write a minor or lah scale in the three following forms—
(*a*) Ascending, using the minor sixth and major seventh.
(*b*) Ascending, using the major sixth and major seventh.
(*c*) Descending, using the minor seventh and minor sixth.

(3) Name the intervals—

(*a*) s–m | f–t$_1$ | t–r | l–m | se–f | se–d | s–re | t–f
(*b*) l–m | fe–r | fe–t$_1$ | ta–m | d^1–se | se–d | ta–s | t–m
(*c*) m^1–s | f–d | r^1–m | d^1–fe | s–f | d^1–se | ta–f | fe–m
(*d*) r^1–m | t–r | d^1–m | fe–d | re–s | se–m | ma–d | fe–r
(*e*) m^1–f | de^1–m | se–d | se–f | fe–d | re–d
(*f*) f^1–s | l–m | de–f | se–r | re–d | ta–r | ma^1–fe | de^1–ma etc.

(4) (*a*) Write in four-pulse measure—the figures show duration in pulses or fractions of a pulse—

1½	½	½	½	½	2	1	½	¼	¼	½	½	½	½	2	1	1			
s	f	r	l	s	rest	d	r	m	f	m	s	r	rest	f	t	rest			
½	¼	¼	½	½	½	½	½												
l	s	f	s	m	r	rest	d	rest.											

(*b*) In three-pulse measure—

2½	½	¾	¼	1	½	¼	½	1½	½	1	½	¼	½	½	½				
m	s	f	l	r	r	m	f	m	rest	f	s	f	m	r	rest				
½	½	1¾	¼	1															
rest	m	r	d	d.															

(*c*) In three-pulse measure—

1	¾	¼	1	1½	½	½	½	½	¾	¼	¼	½	1¾	¼	1	½	½		
s	d	r	m	f	m	r	rest	l	r	m	f	s	m	d	r	m			
1	1	2	1																
f	t$_1$	d	rest.																

(5) (*a*) Rewrite in two-pulse measure, halving the value of each note—

s	: -.m	d	:		Ans.	s	. ,f	: d	.										
r	: m.f	m	: s			r	.m,f	: m	.s										
	: f	t$_1$.d	: r				.f	: t$_1$.d. r											
d	: -	-	: -				d	: -											

(*b*) Rewrite, halving the value of each note and rest—

|d	:-	|m	:-.f |
|s	:f.m	|r	: |
|l.s	:d^1	|s	:m |
|f	:m.r	|d	: |

(*c*) Rewrite, (*a*) doubling the value, (*b*) halving the value, etc.—

|s :-.s|m :r |m : |d :- || etc.

(This type of question is extremely easy.)

(6) Transition—

(*a*) To the first sharp key at (*a*) and back again at (*b*)—

(*a*) (*b*)

m s f l m fe l s d^1 m l fe r s d m f r d.

Ans. m s f l^m l_1 t_1 r d f l_1 r t_1 s_1 s^4 s d m f r d.

(*b*) To the first flat key at (*a*) and back again at (*b*)—

(*a*) (*b*)

m s d^1 s l ta l m^1 r^1 ta s m f l s d^1 t r d^1.

Ans. m s d^1 s^1 m f m t l f r t_1 d^m l s d^1 t r d^1.

(*c*) To the first sharp key at (*a*) and back at (*b*)—

(*a*) (*b*)

m s f l m fe l s d^1 m l fe r s d m f r d.

Ans. m s f l^m l_1 t_1 r d f l_1 r t_1 s^4 s d m f r d.

(*N.B.*—Note the position of the bridge notes and the *octave* marks.)

(7) Which of the following notes is highest in pitch and which lowest?—

(*a*) r^1 key F; f^1 key C; l key $B\flat$; t_1 key D; s_1 key G.

(*b*) f^1 key C; r key A; m_1 key $B\flat$; t key G; s key F; f_1 key $E\flat$.

(*c*) f key A; l key G; s key $B\flat$; m^1 key C; s_1 key $A\flat$; t_1 key D.

(These are best found by constructing a modulator, and working out the position of each.)

(8) Meanings of terms—

Crescendo, adagio, allegro, dal segno, pianissimo, rallentando, poco mosso, meno mosso, leggiero, maestoso, allegretto, dolce, a tempo, staccato, diminuendo, M 80, legato, mezzo forte, presto, sforzando, ad libitum, forte, ritard., andante, syncopation.

(Note that some refer to *pace*, some to *intensity*, and some to *execution*. Explain the term briefly but clearly.)

4. *Penmanship.*—Keep up regular practice. Provide yourself with your usual pens for the examination. Learn absolutely definite rules for length of letters, etc. Letters must not be painted. The downstrokes must be heavier than the upstrokes, but not excessively so. Letters must be equally spaced.

5. *Composition.*—It is impossible and unnecessary to attempt to guess at likely subjects, but students should be prepared to write an essay on one of the *dramatis personæ* of *Julius Cæsar* or on any topic in the special reading books—for example, the character of Louis the Eleventh or Charles of Burgundy, the relations between France and Burgundy, the Bohemians, etc.

Whatever the subject set, it is of the utmost importance that ideas thereon should be arranged in a skeleton plan before commencing to write. Five or ten minutes spent in thinking over the subject and tabulating ideas will more than gain that time in writing.

6. *English.*—The chief points in the grammar and syntax have been sufficiently indicated in the course.

In the history of the language the following questions should be mastered:—

(1.) What changes in the language were produced by the Norman Conquest?

(2.) What is meant by Latin of the first, second, third, and fourth periods?

(3.) How do you account for bilingualism and doublets?

(4.) What was the result of the "strife of tongues" from 1066 to 1250 (*circa*)?

(5.) How can you distinguish words of Teutonic or Anglo-Saxon origin?

(6.) Give examples of words taken from Danish, Celtic, French, Spanish, Italian, Dutch, etc.

(7.) From what languages are the following words taken?—tomahawk, algebra, alligator, yacht, fresco, etc.

(8.) Give examples of words formed from (*a*) names of persons—for example, Boycott; (*b*) names of places—for example, Meander.

In the play of *Julius Cæsar*, students must be able to write a character of each of the prominent persons, to say something of the date and origin of the play, to point out where Shakespeare has deviated from history, to reproduce from memory the substance of any of the longer speeches, to paraphrase passages. Note particularly the following:—

Act I., Scene ii. "Cassius, be not deceived.....to other men."
"That you do love me.....is like to lay upon us."
Scene iii. "You are dull, Casca.....strange eruptions are."
Act II., Scene i. "Lowliness is young ambition's ladder," etc.
"Between the acting of a dreadful thing..... insurrection."
Scene ii. "When beggars die.....when it will come."
Act III., Scene i. "I must prevent thee, Cimber.....satisfied."
"I could well be moved.....to keep him so."
Act IV., Scene ii. "Octavius, I have seen more days than you," etc.
Scene iii. "You must note beside.....lose our ventures."
Act V., Scene v. "This was the noblest Roman.....This was a man."

The explanation of any reference or of any word, the derivation of the chief words, must also be known. The following questions, which have been asked, may be of some service:—

(1.) Explain briefly, as to a class, any peculiarities of grammar or syntax in the following:—

(*a*) "This was the most unkindest cut of all."

(*b*) "With this she fell distract,
And her attendants absent, swallowed fire."

(2.) Explain briefly, with reference to the context:—

(*a*) "Oh, you and I have heard our fathers say,
There was a Brutus once that would have brooked
The eternal devil to keep his state in Rome
As easily as a king."

(*b*) "These many then shall die; their names are pricked."

(*c*) "By heaven, I had rather coin my heart,
And drop my blood for drachmas, than to wring
From the hard hands of peasants their vile trash
By any indirection."

(3.) Paraphrase:—

"Give me your hands all over, one by one,
.....to prick us to redress."

(4.) "This was the noblest Roman of them all." How far does the character of Brutus, as exhibited in the play, bear out this statement?

(5.) Paraphrase the following:—

(*a*) "These couchings and these lowly courtesies
.....spaniel fawning."

(*b*) The abuse of greatness is.....by which he do ascend."

(6.) Explain:—Cæsar's trophies; Erebus; crimsoned in thy lethe; the venom of your spleen; they rob the Hybla bees; I held Epicurus strong; like a Colossus; things unluckily charge my fantasy; dearer than Plutus mine.

(*N.B.*—The context should be given where possible.)

(7.) Explain two of the following, stating the circumstances under which they were spoken:—

(*a*) "For he loves to hear
That unicorns may be betrayed with trees,
And bears with glasses, elephants with holes."

(*b*) "This is a slight unmeritable man,
Meet to be sent on errands: is it fit,
The threefold world divided, he should stand
One of the three to share it?"

(*c*) "The genius and the mortal instruments
Are then in council."

(*d*) "I had rather be a dog, and bay the moon,
Than such a Roman."

(8.) Give such explanations as would be necessary to scholars of the sixth standard of the meaning and force of the following:—

"You must *conceit* me."
"Crimsoned in thy *lethe*."
"The *ides* of March."
"Be *factious* for redress of all these griefs."
"Yon grey lines that *fret* the sky."
"The persuasion of his augurers."
"Senators, prætors, and common suitors."

(9.) Point out grammatical peculiarities in the following, and explain:—

"Would he were fatter."
"That must we also."
"Think ye I am no stronger than my sex, being so fathered and so husbanded?"
"It were a mock apt to be rendered."
"I may do that I shall be sorry for."

(10.) By whom, of whom, and on what occasion were the following said?—

(*a*) "This is a slight unmeritable man,
Meet to be sent on errands."

(*b*) "He will never follow anything
That other men begin."

(*c*) "He thinks too much—such men are dangerous."

(*d*) "This was the noblest Roman of them all."

(*e*) "What a blunt fellow is this grown to be!"

(*f*) "He doth bestride the narrow world like a Colossus."

(*g*) "He sits high in all the people's hearts."

(11.) Whence did Shakespeare obtain the material for the play of *Julius Cæsar?* Give instances showing in what way he used this material, and what additions he made to it.

(12.) At what period in the history of Rome does the action of the play begin? and what events had just taken place which explain the opening scene?

Give the historical facts and dates referred to in these passages:—

(*a*) "You and I have heard our father say
There was a Brutus once."

(*b*) "Many a time and oft
Have you climbed up to wall and battlements
To see great Pompey pace the streets of Rome."

(*c*) "They mean to warn us at Philippi here."

(*d*) "On the Lupercal
I thrice presented him a kingly crown."

Specimen questions on *Quentin Durward* and *The Master of Ballantrae.*

(1.) Give an account of the state of France in Louis the Eleventh's reign (chap. i.).

(2.) Explain the phrases: *Fier comme un Ecossais, tondeurs and écorcheurs, Ecosse en avant, ora pro nobis, Auxerre est le boisson des rois, le moulinet.*

(3.) Who were La Balafré, Dunois, the Wild Boar of Ardennes, La Glorieux, Tristan l'Hermite, Des Comines?

(4.) Give in your own words the circumstances under which Quentin decided to join the Scottish archers.

(5.) Who were the Bohemians? What do you know of their mode of life?

(6.) Explain the following:—"Show him a coat and let him blazon it," "God assoil him," "paladin of Charlemagne," "We must unfold the Oriflamme," "charnels of St. Denis," "to close his ducal coronet with an imperial arch," "The engineer is killed by the springing of his own petard," "the Three Blessed Kings."

(7.) Draw a sketch-map illustrating the boundaries between Burgundy and France, and mark on it Quentin's journey.

(8.) Contrast the characters of the King of France and the Duke of Burgundy.

(9.) Give an account of the attack on Liége.

(10.) Compare the characters of Countess Isabelle and Lady Hameline.

(11.) Write a character of *The Master of Ballantrae.*

(12.) Explain the following:—White cockade, sneckdraw, acolytes, Jolly Roger, the labours of Hercules, your Volscians in Corioli, Grub Street, cache, bridged the Tweed and split the Eildons, sahib.

(13.) Who were the Chevalier, Captain Teach, General Clinton, Captain Harris, Jacob Chew, Secundra Dass?

(14.) What is the moral you would draw from *The Master of Ballantrae?*

(15.) "He had all the gravity and something of the splendour of Satan in the *Paradise Lost.*" Explain this, and illustrate its truth.

7. *Geography.*—With such a wide subject as geography, it is often a matter of difficulty to students to know how to revise. The following suggestions may be of service:—

(1.) Look over all the questions set in the course. These comprise nearly all the recent Government tests.

(2.) Make quite sure that you know in each country imports, exports, chief towns, and form of government. The latter is very important in the colonies.

(3.) The chief ports of each country and the trade routes should be known.

(4.) Take an ordinary school atlas, and go over each country *seriatim.* Satisfy yourself that you know the position and some facts of importance with regard to each of the most important towns.

(5.) Practise sketch-maps of all the colonies and the chief countries of the earth.

(6.) Take towns that have rapidly developed of recent years, and find out the reasons.

(7.) In what particulars do the governments of the Dominion of Canada and the Commonwealth of Australia agree, and in what do they differ?

(8.) What forms of colonial government are there? Give examples of each.

(9.) The goods imported into England, and whence they come. (*a*) Foodstuffs; (*b*) raw materials for manufacture; (*c*) manufactured goods.

(10.) The great railways and canals of the world.

In answering the paper, make your answers as condensed as possible. Facts are required. Illustrate by means of sketch-maps wherever you can. Always tabulate, if the answer in any way admits of it.

8. *History.*—Notebooks and synopses should be used for revision. The following points should be thoroughly known:—

(1.) Genealogical tables, showing the exact descent of each dynasty.

(2.) Growth of the constitution—Witanagemote, Magnum Concilium, Curia Regis, House of Commons, Bill of Rights, Reform Bills, etc.

(3.) Battles (with plans of the chief)—for example, Aylesford, Mount Badon, Heathfield, Ellandune, Hengest's Down, Ashdown, Ethandune, Brunanbury, Stamford Bridge, Hastings, Gerberoi, Alnwick, Tenchebrai, The Standard, Lincoln, Bouvines, Fair of Lincoln, Lewes, Evesham, Cambuskenneth, Falkirk, Bannockburn, Boroughbridge, Sluys, Crecy, Neville's Cross, Poictiers, Navaretta, Radcot Bridge, Homildon Hill, Shrewsbury, Bramham Moor, Agincourt, of Herrings, of the Wars of the Roses, Stoke, Guinegate (Battle of the Spurs), Flodden, Halidon Hill, Solway Moss, Pinkiecleugh, Langside, Zutphen, of the Civil War (1642–9), Dunbar, North Foreland, Southwold, Sedgemoor, Killiecrankie, Steinkirk, Landen, Namur, La Hogue, Blenheim, Ramilies, Oudenarde, Malplaquet, Sheriffmuir, Prestonpans, Culloden, Minden, Plassey, Lagos, Quiberon Bay, Lexington, Bunker Hill, Saratoga, of the Saints (Rodney, in 1782), St. Vincent, Camperdown, Vinegar Hill, the Nile, Trafalgar, Copenhagen, Roliça, Vimiera, Talavera, Busaco, Albuera, Salamanca, Vittoria, Orthes, Toulouse, Ligny, Quatre Bras, Waterloo, etc.

(4.) Treaties and Peaces:—Aix-la-Chapelle, Amiens, Breda, Bretigny, Cateau-Cambresis, Fontainebleau, Ghent, Northampton, Ryswick, Utrecht, Wedmore, Troyes, Berwick, Brigham, Dover, Estaples, Mise of Lewes, Paris, Pecquigny, Versailles, Wallingford.

(5.) Chief men, including:—Aidan, André, Anselm, Anson, Atterbury, Bede, Blake, Bonnor, Byng, Cade, Cecil, Chaucer, Cobden, Columba, Coverdale, Cranmer, Danby, De Burgh, De Montfort, Des Roches, Despensers, Dunstan, Dupleix, Eliot, Eustace of Boulogne, Sir Thomas Fairfax, Flambard, Frobisher, Gardiner, Gilbert, Grossetesto, Hampden, Havelock, Hereward, Hooper, Rowland Hill, Walter Hubert, Hyde, Jeffreys, Ket, Langton, Longsword, Luther, William Marshall (Earl of Pembroke), Montrose, More, Morton, Neville (Earl of Warwick), Newton, Oates, O'Connell, Oldcastle, Outram, Peter the Hermit, Gaveston, Porteous, Pym, Ridley, Prince Rupert, Sacheverell, Algernon Sidney, Strafford, Sidney, Washington, Wolfe, Wolsey, William of Wykeham.

(6.) Causes and results of rebellions and conspiracies—for example, Argyle's, Babington's, Cade's, Gordon's, Gunpowder, Ket's, Mar's, Monmouth's, Young Pretender's, Percies', Pilgrimage of Grace, Simnel's, Simon de Montfort's, Tyler's, Wyatt's, etc.

(7.) Chief statutes passed, and their terms.

9. *Arithmetic.*—The only revision needed is a final look at the theory of each rule, and the perfecting of definitions.

10. *Algebra.*—Theory. Factors and general papers.

11. *Euclid.*—The whole should be thoroughly known. It is impossible to get the whole paper finished in the time allowed, unless the propositions are well known and the deductions easily solved. It is better to write out answers to all the direct questions, leaving the deductions till the last.

12. *General Information.*—Look through all the papers which have been set, and the special articles on the subject.

Notes on the October Questions.

1. The places were generally located correctly.

2. The "City" of London is a comparatively small part of London, under the jurisdiction of the Lord Mayor.

3. Many students went wrong by saying that to tell the composition of a star was mere guessing. This is not so. The spectroscope is infallible. When white light is passed through a prism, a continuous spectrum is formed; but the spectrum of incandescent materials, such as sodium, gives a number of bright lines, always in the same position. But if the white light has passed through incandescent vapour, the continuous spectrum is crossed by dark lines (Fraunhofer's) exactly where the bright lines

previously appeared. If the solar spectrum is closely examined, many of these lines will be seen, caused by the sunlight passing through the glowing vapours of different substances; and as there are none of these glowing vapours in our atmosphere, they must be in the sun's atmosphere. Similarly with a star. Photography is used to obtain an accurate account of these lines.

4. The *Golden Hind* was Drake's famous ship; the *Centurion*, Commodore Anson's.

5. The classes of clouds were correctly given, but why they appear white or black was not clearly explained. A dense cloud reflects the sun's light, and the upper part appears a dazzling white, while the lower part is dark from the absorption of light rays.

6 and 7 were well done.

8. In giving an account of meteorites or shooting stars, little was said of their composition or where they come from.

Hints for the Examination.

1. Do not forget your permission to sit.
2. Read all instructions very carefully. Fill up all forms before commencing work.
3. Allow a few minutes for studying and selecting the questions.
4. Divide up your time between the questions, and keep to the time. Thus, if you have six questions in two hours, you have twenty minutes per question. Devote two or three to thinking the subject over, fifteen to writing, and two or three to revision.
5. Put down what you know as clearly and concisely as you can. No examiner is deceived by a long, wandering answer which contains very little information.
6. Work your hardest, but do not hurry.
7. Provide yourself with all the apparatus (pens, etc.) you are likely to need.
8. Do not discuss your answers with others. If you are right, it does not increase your marks; and if you are wrong, it probably upsets you for the next paper.

I shall be glad to hear from my correspondents of their success.

Next month we shall commence a new course for 1903.

PUPIL TEACHERS' COURSE.

For Candidates' Examination, 1903.

1. *Reading and Repetition.*—Regular practice in both of these subjects is very necessary.

2. *English.*—Ver. 25–28, Gray's *Elegy in a Country Churchyard.*

Ver. 25. "In answer to your inquiries, some white-headed old man may say, 'We often used to see him, as soon as it was light, walking hurriedly through the dewy field to watch the sun rise upon the uplands.'"

Some. Indefinite demonstrative.
Brushing. Participle, imperfect, qualifying "him."
To meet. Infinitive of purpose, limiting *brushing.*

Ver. 26. "At midday his favourite place was under that old waving beech with its peculiarly twisted roots. There he would lie for hours gazing at the brook which wanders by."

There. Adverb, modifying "would stretch."
Yonder. Demonstrative adjective, limiting *beech.*
So. Adjective of degree, modifying "high."
Would (= used to). Parse as a principal verb.
Stretch. Verb, infinitive mood, governed by *would.*
Pore—that is, "would pore."

Ver. 27. "At other times we used to see him wandering by yonder wood muttering and talking to himself, or wandering silently as if he were the victim of some great loss, or oppressed with the weightiest cares, or the object of unrequited affection."

Hard. Adverb, modifying the phrase "by yon wood."
As. Conjunction, adverbial, joining two elliptical sentences—(1) Now he would be smiling; (2) he was smiling in scorn.
Drooping, woeful wan, crazed, crossed, all refer to *he.*
Like. Adjective, limiting *he,* governing *one* in the objective case.

Ver. 28. "One morning he did not come to his usual place to view the sunrise, nor did he appear at all during the day in his accustomed haunts. On the following day also he was nowhere to be seen."

Morn. Abstract noun, adverbial object.
Another. Indefinite pronoun.

3. *History.*—James the First, Charles the First, and the Commonwealth.

Learn a genealogical table showing James the First's right to the throne. Study particularly the opinions held by him—Divine Right, etc., which caused all the trouble for the next one hundred and eighty years. The Hampton Court Conference indicates the growing strength of the Puritan party, as also do the proceedings in the House of Commons.

The Gunpowder, Main, and Bye Plots, the Plantation of Ulster, and the emigration of the Pilgrim Fathers are other important topics.

Charles the First had all his father's opinions, and much more decision. The whole reign was a struggle for absolute supremacy on the part of the king, and for constitutional government on the part of the people. By the able aid of Wentworth, Charles ruled eleven years absolutely, and might have continued to do so till his death but for his very ill advised attempt to force Episcopacy upon Scotland. This led to the summoning of the Long Parliament, the outbreak of civil war, and his final downfall.

Learn exactly all there is in your text-book about Petition of Right, Ship Money, Grand Remonstrance, National Covenant (1638), Solemn League and Covenant (1643), Pride's Purge, Self-Denying Ordinance, New Model. Prepare lives of Hampden, Pym, Fairfax, Rupert, Cromwell, Falkland, Monk, Laud, Strafford, and other chief leaders.

Make a table of the battles, leaders, and results, and prepare a map of England showing the position of places at which engagements took place.

The Commonwealth.—The reduction of Scotland and Ireland, the changes in the form of government, Cromwell's foreign policy, are the chief points.

4. *Geography.*—Productions, manufactures and other industries. Towns, etc., of Scotland. Tabulate in your notebooks and commit to memory. Draw maps and insert all places to be remembered, till you can do so from memory. Until you can do this the work is not known.

5. *Arithmetic.*—The application of decimals to weights and measures, and problems in decimals.

A very common mistake is to reduce all decimals to vulgar fractions when finding the value as applied to quantities—for example, "Find the value of ·56875 of £3." The decimal must not be reduced to a vulgar fraction, but the result found by direct multiplication, thus—

$$\begin{array}{r} \cdot 56875 \\ \underline{\quad\quad 3} \\ \pounds\ 1\cdot 70625 \\ \underline{\quad\quad 20} \\ s.\ 14)12500 \\ \underline{\quad\quad 12} \\ d.\ 1)500 \\ \underline{\quad\quad 4} \\ 2 \end{array} \quad = £1,\ 14s.\ 1\tfrac{1}{2}d.$$

6. *Euclid.*—Book I., Props. 18–21, with two deductions per week.

7. *Algebra.*—Chaps. ix. and x. Symbolical expressions and problems leading to simple equations.

8. *Elementary Science.*—The barometer, siphon, and common pump.

9. *Music.*—Divisions of a pulse, and rests.

Test Questions.

1. *Penmanship.*
Large hand—*Parliamentarians.*
Small hand—*Here rests his head upon the lap of Earth,*
A youth to Fortune and to Fame unknown.

2. Analyse the following, and parse words in italics:—

"For *thee, who,* mindful of the unhonoured dead,
Dost in these lines their artless tales relate,—
If chance, by lonely *Contemplation led,*
Some kindred spirit *may inquire* thy fate,
Haply some hoary-headed swain may say."

3. Write a short essay on "The Village Churchyard" as depicted by Gray.

4. What caused so much discontent among the poor in Tudor times? What risings took place, and with what results?

5. Describe the defeat of the Armada.

6. Write a few lines about four of the following—Drake, More, Protector Somerset, Raleigh, Cecil, Shakespeare.

7. Where and what are—Kyles of Bute, Trossachs, Fingal's Cave, Bell Rock, Crinan, Cairngorm?

8. Contrast the eastern and western shores of Scotland. How do you account for the great difference?

9. (*a*) Express $\frac{1\cdot\dot{5}47\dot{6} \times 10\cdot618}{2\cdot\dot{6}547}$ in its simplest form.

Ans. 6·19.

(*b*) Show that $\frac{91}{256}$ will not produce a recurring decimal.

(*c*) A's share is ·0̇0̇ of B's, B's is 3·08 of C's, C's is 1·1 of D's. C's share is £2750. Find A's, B's, and D's.

Ans. A £770. B £8470. D £2500.

10. How would you prove that liquids transmit pressure equally in all directions? What use is made of this in building a reservoir?

First and Second Years.

1. *Reading and Repetition.*—Oral practice is necessary, but book reading and repetition should include much more than is specified in the syllabus. One good book per month should be read.

2. *English: First Year.*—Cowper's *Task*, Book V., lines 242–271, *or* Cowper's *Expostulation*, lines 241–272.

Second Year.—Milton's *Paradise Lost*, Book III., lines 416–475, with knowledge of all allusions, meanings, derivations of chief words.

(Full notes on these poems have appeared in these columns, or are to be found in the editions published by Messrs. T. Nelson and Sons.)

Special Study.—(*a*) The adjective. Classification, comparison, etc.

(*b*) Palgrave's *Golden Treasury of Songs and Lyrics.*

Study Nos. 108, 109, 116, 117, 118, 127, and 129.

No. 108. *Robert Herrick* was born in London in 1591. Entered the church, and in 1629 made vicar of Dean Prior in Devonshire. He lost his vicarage on the outbreak of the Civil War, and migrated to London, returning to Devonshire after twenty years' absence. He died there in 1674. During his stay in London he associated with the witty and learned writers there, and many of his poems are hardly what one would expect from a churchman. His lyrics are among the finest in the language; the thought is gay and cheerful, the expression exquisite and melodious. The specimens given in the book are his best, and deserve careful attention.

109. *Richard Lovelace* (1618–58), an accomplished Cavalier poet. Thrown into prison by the Long Parliament; served in the French army; returned to England, and was again imprisoned. Liberated at the Restoration, but having spent his fortune for the Stuarts, was, like many another, neglected by Charles the Second. His poetry is very unequal. Some of it (as the poem here given) is noble in sentiment and expression. Lucasta was Miss Lucy Sacheverell. They loved each other, but she, hearing that he had died of his wounds at Dunkirk, married another.

No. 116. This beautiful song breathes the ardent spirit of the age—that intense interest in life and its surroundings which produced the great men of the Elizabethan age.

No. 129. *Sir John Suckling* (1609–41). Educated at Cambridge; served in Sweden; one of the most brilliant of Charles the First's courtiers. He joined a scheme to release Strafford; but the plot being discovered, he had to fly to France, where he died. His poems are bright and sparkling, with touches of admirable audacity. The petulant expression at the end of the poem is quite characteristic of the man.

3. *History: First Year.*—Henry the Seventh and Henry the Eighth.

These are two very important reigns, and require most careful study. It is a new era. The Dark Ages have passed away, and a flood of light and learning spread over Europe. Be prepared to answer questions on these topics:—

(1.) The causes why the Tudors were practically absolute.
(2.) The means by which Henry the Seventh amassed money.
(3.) The risings against him.
(4.) His marriage schemes, and their results.
(5.) Wolsey and his policy.
(6.) The battle of Flodden.
(7.) The Reformation—(*a*) causes; (*b*) the divorce question; (*c*) the demands of the Reformers.

Second Year.—1837–1900. Besides the events in the text-book, pay particular attention to the developments, discoveries, and progress of the century.

4. *Geography: First Year.*—Siberia, China, and Japan.

Second Year.—Australia.

Abundant use must be made of maps, and particular attention given to productions, imports, exports, towns, and government. The recent rapid development of Japan should be noted, and a clear idea gained of the Commonwealth of Australia and its government.

5. *Arithmetic: First Year.*—Profit and loss.

Second Year.—Measurement of areas and solids.

The theory of profit and loss must be very carefully studied, and also the examples worked out in the text-book. The chief point to notice is that in all cases profit is reckoned on the cost price.

6. *Euclid: First Year.*—Props. 33–36, with two deductions per week.

Second Year.—Finish Book II., with four deductions per week.

7. *Algebra: First Year.*—Chap. xi., Hall and Knight, G.C.M. and L.C.M.

Second Year.—Chaps. xxi. and xxii. Fractions.

8. *Elementary Science.*—Finish the subject.

Test Questions.

First Year.

1. Analyse the following, and parse words in italics:—

"Then Truth is hushed *that* Heresy *may preach*,
And all is trash *that* Reason cannot reach,
And Faith, the *root whence only* can arise
The graces of a life that wins the skies,
Loses *at once* all value and esteem."

Or, "But war's a game which, *were* their subjects wise,
Kings would not play *at*. Nations would do well
To extort their truncheons from the puny hands
Of heroes, whose infirm and baby minds
Are gratified with mischief, and who spoil
Because men suffer it, their *toy* the *world*."

2. Define, with examples, reciprocal, emphatic, and reflexive pronouns.

3. Explain the part played by Warwick, the King-maker, in the Wars of the Roses.

4. What were "benevolences"? How were they collected, and when were they abolished?

5. Say what you can of the monsoons, and their effects on India.

6. How is India governed? In what ways has the country benefited from the British occupation?

7. (*a*) A man spends 4 per cent. of his money, and then 5 per cent. of what remains. What percentage of his money has he left? Ans. 91¼.

(*b*) A ship depreciates in value each year at the rate of 10 per cent. of its value at the beginning of the year, and its value at the end of 3 years is £14580. What was its original value?

Ans. £20000.

(*c*) For what sum should a ship worth £7250 be insured at £3, 6s. 8d. per cent., so that the owner might recover, in case of loss, the value of the ship and the insurance? Ans. £7500.

(*d*) A warehouse contains goods worth £17230, and is insured only for 86·3 per cent. of its value. What sum would be lost in case of its destruction by fire? Ans. £2360, 10s. 2½d.

8. How would you prove by analysis and synthesis that white light is composed of seven colours?

Second Year.

1. Analyse the following, and parse words in italics:—

"*No sooner* had the Almighty ceased, *but* all
The *multitude* of angels, with a shout
Loud *as* from numbers without number, sweet
As from blest voices, *uttering* joy, heaven rung
With jubilee, and loud hosannas filled
The eternal regions. *Lowly* reverent
Toward *either* throne they bow."

2. Write a short essay on the universe as conceived by Milton.

3. Give an account of the Peninsular War.

4. What do you know of the Catholic Emancipation Bill?

5. Give some account of the fauna and flora of South America.

6. What do you know of Pernambuco, Callao, Valparaiso, Caracas, Rio Janeiro, Buenos Ayres?

7. (*a*) If I transfer £1000 from 3 per cent. stock at 92 to a 4 per cent. stock and gain £1, 5s. 0d. in income, find the price of the latter stock. Ans. £117½.

(*b*) The 3 per cents. being at 93, determine the interest obtained for money thus invested. Ans. £3 3/11.

(*c*) What would be the half-yearly dividend from an investment of £3300 in the 3½ per cents., when the stock is at 91?

Ans. £58, 18s. 6½d.

8. Define and explain declination, inclination, and intensity of magnetic force. How is each measured?

CORRESPONDENCE: RULES (as usual).

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Familiar foreign phrases in constant use :—

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Ars longa, vita brevis, Art is long, life is short.
Bis dat qui cito dat, He gives twice who gives quickly.
Casus belli, a cause for war.
Cave canem, Beware of the dog.
Cui bono? Whom does it benefit?
Deo volente, God willing.
Ecce homo! Behold the man!
Ex cathedra, from the chair; with authority.
Exempli gratiâ, by way of example.
Festina lente, Hasten slowly. (Compare "More haste less speed.")
Flagrante delicto, in the very act.
Hic et ubique, here and everywhere.
In articulo mortis, at the point of death.
Index expurgatorius, list of forbidden books.
In loco parentis, in the place of a parent.
In statu quo, in the state in which it was.
Lapsus linguæ, a slip of the tongue.
Locum tenens, a substitute or deputy.
Materia medica, substances used in medicine.
Mens conscia recti, a mind conscious of right.
Mens sana in corpore sano, a sound mind in a sound body.
Non compos mentis, not in a sound mind.
Nota bene, Mark well.
Nulli secundus, second to none.
Obiter dictum, a thing said by the way.
Otium cum dignitate, ease with dignity.
Paterfamilias, the father of a family.
Pax vobiscum, Peace be with you.
Per mare, per terra, by sea and land.
Per se, by itself.
Post mortem, after death.
Primâ facie, at first sight.
Pro bono publico, for the public good.
Quid nunc? What now? a newsmonger.
Quid pro quo, one thing for another. (Compare "tit-for-tat.")
Quondam, former.
Semper idem, always the same.
Sic passim, so everywhere.
Sic transit gloria mundi, So passes away the glory of the world.
Sine die, without a day being appointed.
Sine quâ non, an indispensable condition.
Sub rosa, under the rose; privately.
Vade mecum, Go with me; a constant companion.
Vox populi, vox Dei, The voice of the people is the voice of God.

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Czar, or *Tzar*, the title of the Emperor of Russia; his wife is the *Czarina*. The eldest son is the *Czarowitz*, and his wife the *Czarevna*.

Sultan, the ruler of Turkey; *Sultana*, his wife.
Mikado, the Emperor of Japan.
Shah, the ruler of Persia.
Rajah, a native ruler in Hindustan.
Begum, a princess in Hindustan.
Ameer, the ruler of Afghanistan.
Bey, a Turkish governor of a province.
Khedive, the ruler of Egypt.

Flotsam and jetsam. Goods that are either thrown overboard to lighten a ship in distress, or washed out of a ship by the waves, are so called as long as they continue at sea either floating (flotsam) or at the bottom (jetsam). When cast on shore the goods are known as wreckage.

Tally and *score.* These terms come to us from the time when accounts were kept by cutting or scoring on a stick known as a tally-stick. The stick was split down the centre, so by placing the two halves together it was at once seen if the two accounts "tallied." Tally-sticks are still largely used by bakers in France.

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standard mark, showing the quality; (3) the arms of the company, showing the place of assay; (4) a letter (changed every year), showing the date. The standard marks are—a crown and the figures 22 for gold of 22 carats; a crown and the figures 18 for gold of 18 carats; a lion's head and Britannia for silver of 11 oz. 10 dwt.; a lion passant for silver of 11 oz. 2 dwt. The arms of the companies are—leopard's head (London); anchor (Birmingham); a sword between three garbs (Chester); castle (Newcastle); crown (Sheffield); cross and five lions (York).

WEEKLY REVISION TESTS IN MATHEMATICS FOR SCHOLARSHIP AND MATRICULATION STUDENTS.

IX.

A. 1. Simplify—

$$\sqrt{\frac{(x^2+y^2)^2-(x^2-y^2)^2}{(x^2-y^2)^2+4x^2y^2}}+\frac{x^4-y^4}{\sqrt{(x^2+y^2)^2-4x^2y^2}}-2\left\{\frac{x+y}{\frac{1}{x}+\frac{1}{y}}\right\}^2.$$

2. How can you discover, without performing the operations indicated, that the result in each of the following cases is wrong?

(*a*) $(a+1)(a-2)(a+3)=a^3+2a^2-5a+6$.

(*b*) $x=2$ satisfies the equation $x^5-4^5=6$.

3. If p and q be the roots of the equation $x^2-ax+b=0$, prove that $p+q=a$ and $pq=b$.

Solve $\dfrac{2x-3}{3x-2}+\dfrac{2}{3}=\dfrac{3x-2}{2x-5}$.

4. A and B started together to run a race. At the end of five minutes, when A had run 900 yards at a uniform rate, and was 75 yards ahead, he slackened his speed by 20 yards a minute, and thus reached the winning-post half a minute after B, who ran uniformly throughout. How long did the race last?

5. If R is the remainder when P is divided by Q, prove that the H.C.F. of Q and R is the same as that of P and Q.

If m and n are two integers, with no common divisor except unity, then m^2+n^2 and m^2-n^2 can have no common divisor other than 2.

B. 1. Define straight line, plane angle, figure, semicircle, rhombus, axiom.

Construct a $\triangle$, having given two sides and an $\angle$ opposite to one of them. Show that there may be two solutions, one, or none.

2. The diagonals AC, BD of a rectangle ABCD intersect in E. Prove EA = EB. If CF be drawn at right angles to AC to meet AB produced in F, show that the $\angle$ AFC = $\angle$ ADB.

3. From a point F on the diagonal AC of a parallelogram ABCD lines are drawn parallel to the sides, dividing the original parallelogram into four figures. Prove that the pair not cut across by the diagonal AC are equal in area. Find the position of F on the diagonal for maximum area.

4. If A, B, C be any three points, and O the middle point of BC, then the squares on AC and AB are together double the squares on AO and OC.

5. In the equal sides PQ, PR of the isosceles $\triangle$ PQR find S and T in PQ, PR respectively, so that QS = ST = TR.

X.

A. 1. Prove that if c be any positive integer, a and b having any values whatever, then $(a+b)c=ac+bc$; and hence deduce that if d be any positive integer,

$$(a+b)\times\frac{c}{d}=a\times\frac{c}{d}+b\times\frac{c}{d}.$$

2. Find the term involving a^2b in the product of $a^2+3ab+5b^2$ and $3a^2-5ab+4b^2$, without performing the whole of the multiplication.

Divide $1-x+x^2-x^3+\ldots-x^{2p+1}$ by $1+x^2+x^4+\ldots+x^{2p}$.

3. Show that $(7a+6b+5c)^2-(5a+6b+7c)^2=24(a-c)(a+b+c)$;

and simplify $\dfrac{1}{x-y}-\dfrac{2x}{x^2-y^2}-\dfrac{3x^2}{x^3-y^3}$.

4. A tradesman started in business with £1,200, and in the first year he makes a certain percentage of profits, from which he takes £164, and adds the rest to his capital. In the next year he makes the same percentage profit, and having again withdrawn £164, he has £1,422. What percentage of profit did he make?

5. Find the value of k in order that

$$x^6+2x^5+3x^4+4x^3+3x^2+2x+k$$

may be a perfect square; and write down the cube root of

$$x^6-3x^5+6x^4-7x^3+6x^2-3x+1.$$

B. 1. In the quadrilateral ABCD the $\angle$ ABC is a right $\angle$, and the square on AD is equal to the sum of the squares on AB, BC, and CD. The diagonal AC being drawn, show that the $\angle$ ACD is a right $\angle$.

2. If one $\triangle$ lies entirely inside another one, prove that the sum of the sides of the former is less than the sum of the sides of the latter.

Is a corresponding theorem true for two quadrilaterals?

3. If the opposite sides of a quadrilateral are equal, show that it is a parallelogram.

ABCD is a parallelogram having the diagonal AC equal to the side AB. Show that the diagonal BD is greater than any one of the sides of the parallelogram.

4. In an acute $\angle$d $\triangle$ ABC, lines AD, BE, CF are drawn from the vertices perpendicular to the opposite sides. Prove that the square on AC is less than the sum of the squares on the other two sides by twice the rectangle BC . BD.

Deduce that the rectangle BC . BD = rectangle BA . BF; also that the square on AC = sum of the rectangles AB . AF and CB . CD.

5. In the $\triangle$s LMN, PQR the angles N and R are right angles, MN is half LM, QR is half PQ, and LN equals PQ. Show that PR is three-fourths of LM.

XI.

A. 1. The sum of two numbers multiplied by the greater is 352, and their difference multiplied by the less is 60. Find them.

2. Prove that $(x-1)$ is a factor of

$$77(x-1)(x-98)^2+x^3-100x^2+197x-98,$$

and find the other factors.

3. Show that if $a^2=b^2+c^2$, then

$$a+b+c:c+a-b=a+b-c:b+c-a.$$

4. Prove that the sum of the cubes of any three consecutive numbers is divisible by the sum of the numbers, and state in words the value of the remaining factor.

Prove that the difference between the squares of a number of two digits, and of the number obtained by reversing the digits, is 99 times the difference of the squares of the digits.

5. Solve (*a*) $\dfrac{3}{x}+\dfrac{5}{y}=19$; $\dfrac{7}{x}-\dfrac{9}{y}=3$.

(*b*) $(x^2+x+1)^2-4(x^2+x-1)-5=0$.

(*c*) $\dfrac{x}{a}+\dfrac{y}{b}=2ab=\dfrac{x}{b}+\dfrac{y}{a}$.

B. 1. The angles B and C of a $\triangle$ ABC are acute, and C > B; P is a point in BC. Show that AP is shorter than AB, and find when AP will also be shorter than AC.

2. P is a point in AB, one of the shorter sides of a given rectangle ABCD. Show how to construct a rhombus, having an angular point at P, and its other angular points on each of the other sides of the rectangle.

3. Given a line AB, show how to produce it to a point P, so that rectangle AP . PB = square on AB.

4. Upon the same base AB, and upon opposite sides of it, the parallelograms ABCD and ABEF are described, so that the side AD of the first is equal to the diagonal AE of the second, and the diagonal AC of the first is equal to the side AF of the second. Prove that AC and AF, as also AD and AE, are in the same straight line.

5. Construct a $\triangle$ with sides 2, 2·5, 3 inches in length, and find its area in square inches correct to one place of decimals, explaining your method.

XII.

A. 1. Find the value of a for which the roots of the equation $4x^2+2x+a=0$ are equal, and form the equation whose roots are $3+\sqrt{2}$ and $3-\sqrt{2}$.

2. Define a mean proportional. If $a:b::c:d$, show that $\sqrt{abcd}\,\{a^2-b^2-c^2+d^2\}$ is a mean proportional to $(ac-bd)^2$ and $(ab-cd)^2$.

3. Show that the sum of the squares of any three consecutive odd numbers, increased by one, is always divisible by 12.

4. If $x+3y-5z=4x-2y-7z=3x-y-3z$, find the ratios of x, y, z.

5. Find the lengths of the two segments into which a line m feet long must be divided, in order that the areas of the squares on them may be together equal to n square feet. Work out the results numerically to the hundredth of an inch, when $m=10$ and $n=64$. When is the problem impossible?

B. 1. A and B are two fixed points. A point P moves so that PA is always equal to PB. Find the locus traced out by P.

Hence find the centre of a circle passing through three given points.

2. Show how to construct a rectangle of given perimeter, whose area shall equal that of a given rectangle. What is the least length the given perimeter may have?

3. In the $\triangle$ ABC the angles at A and C are each half a right angle; AD is drawn bisecting the angle at A and meeting BC in D. Show that the square on DC is double the square on BD.

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2. How can you discover, without performing the operations indicated, that the result in each of the following cases is wrong?

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Divide $1-x+x^2-x^3+\ldots-x^{2p+1}$ by $1+x^2+x^4+\ldots+x^{2p}$.

3. Show that $(7a+6b+5c)^2-(5a+6b+7c)^2=24(a-c)(a+b+c)$;

and simplify $\dfrac{1}{x-y}-\dfrac{2x}{x^2-y^2}-\dfrac{3x^2}{x^3-y^3}$.

4. A tradesman started in business with £1,200, and in the first year he makes a certain percentage of profits, from which he takes £164, and adds the rest to his capital. In the next year he makes the same percentage profit, and having again withdrawn £164, he has £1,422. What percentage of profit did he make?

5. Find the value of k in order that

$$x^6+2x^5+3x^4+4x^3+3x^2+2x+k$$

may be a perfect square; and write down the cube root of

$$x^6-3x^5+6x^4-7x^3+6x^2-3x+1.$$

B. 1. In the quadrilateral ABCD the $\angle$ ABC is a right $\angle$, and the square on AD is equal to the sum of the squares on AB, BC, and CD. The diagonal AC being drawn, show that the $\angle$ ACD is a right $\angle$.

2. If one $\triangle$ lies entirely inside another one, prove that the sum of the sides of the former is less than the sum of the sides of the latter.

Is a corresponding theorem true for two quadrilaterals?

3. If the opposite sides of a quadrilateral are equal, show that it is a parallelogram.

ABCD is a parallelogram having the diagonal AC equal to the side AB. Show that the diagonal BD is greater than any one of the sides of the parallelogram.

4. In an acute $\angle$d $\triangle$ ABC, lines AD, BE, CF are drawn from the vertices perpendicular to the opposite sides. Prove that the square on AC is less than the sum of the squares on the other two sides by twice the rectangle BC . BD.

Deduce that the rectangle BC . BD = rectangle BA . BF; also that the square on AC = sum of the rectangles AB . AF and CB . CD.

5. In the $\triangle$s LMN, PQR the angles N and R are right angles, MN is half LM, QR is half PQ, and LN equals PQ. Show that PR is three-fourths of LM.

XI.

A. 1. The sum of two numbers multiplied by the greater is 352, and their difference multiplied by the less is 60. Find them.

2. Prove that $(x-1)$ is a factor of

$$77(x-1)(x-98)^2+x^3-100x^2+197x-98,$$

and find the other factors.

3. Show that if $a^2=b^2+c^2$, then

$$a+b+c:c+a-b=a+b-c:b+c-a.$$

4. Prove that the sum of the cubes of any three consecutive numbers is divisible by the sum of the numbers, and state in words the value of the remaining factor.

Prove that the difference between the squares of a number of two digits, and of the number obtained by reversing the digits, is 99 times the difference of the squares of the digits.

5. Solve (*a*) $\dfrac{3}{x}+\dfrac{5}{y}=19$; $\dfrac{7}{x}-\dfrac{9}{y}=3$.

(*b*) $(x^2+x+1)^2-4(x^2+x-1)-5=0$.

(*c*) $\dfrac{x}{a}+\dfrac{y}{b}=2ab=\dfrac{x}{b}+\dfrac{y}{a}$.

B. 1. The angles B and C of a $\triangle$ ABC are acute, and C > B; P is a point in BC. Show that AP is shorter than AB, and find when AP will also be shorter than AC.

2. P is a point in AB, one of the shorter sides of a given rectangle ABCD. Show how to construct a rhombus, having an angular point at P, and its other angular points on each of the other sides of the rectangle.

3. Given a line AB, show how to produce it to a point P, so that rectangle AP . PB = square on AB.

4. Upon the same base AB, and upon opposite sides of it, the parallelograms ABCD and ABEF are described, so that the side AD of the first is equal to the diagonal AE of the second, and the diagonal AC of the first is equal to the side AF of the second. Prove that AC and AF, as also AD and AE, are in the same straight line.

5. Construct a $\triangle$ with sides 2, 2·5, 3 inches in length, and find its area in square inches correct to one place of decimals, explaining your method.

XII.

A. 1. Find the value of a for which the roots of the equation $4x^2+2x+a=0$ are equal, and form the equation whose roots are $3+\sqrt{2}$ and $3-\sqrt{2}$.

2. Define a mean proportional. If $a:b::c:d$, show that $\sqrt{abcd}\,\{a^2-b^2-c^2+d^2\}$ is a mean proportional to $(ac-bd)^2$ and $(ab-cd)^2$.

3. Show that the sum of the squares of any three consecutive odd numbers, increased by one, is always divisible by 12.

4. If $x+3y-5z=4x-2y-7z=3x-y-3z$, find the ratios of x, y, z.

5. Find the lengths of the two segments into which a line m feet long must be divided, in order that the areas of the squares on them may be together equal to n square feet. Work out the results numerically to the hundredth of an inch, when $m=10$ and $n=64$. When is the problem impossible?

B. 1. A and B are two fixed points. A point P moves so that PA is always equal to PB. Find the locus traced out by P.

Hence find the centre of a circle passing through three given points.

2. Show how to construct a rectangle of given perimeter, whose area shall equal that of a given rectangle. What is the least length the given perimeter may have?

3. In the $\triangle$ ABC the angles at A and C are each half a right angle; AD is drawn bisecting the angle at A and meeting BC in D. Show that the square on DC is double the square on BD.

4. On the sides BC, CA, AB of an equilateral △ the three equilateral △s BCD, CAE, ABF are drawn. Prove that D, E, F are at the corners of an equilateral △.

5. If the angle A of a △ ABC be obtuse, the square on BC exceeds the sum of the squares on BA, AC by twice a certain rectangle. State what rectangle this is, and prove the theorem.

The side QR of an equilateral △ PQR is produced to S, so that RS = QR. Prove that the square on PS is three times the square on PR.

Solutions.

IX.

A. 1. $\frac{2xy}{x^2+y^2} + (x-y)^2$.

2. (*a*) The third term in the result is given as + 6. This is the product of 1, − 2, and 3, and therefore cannot be + 6.

(*b*) $4^3 = 2^6$; ∴ when $x = 2$, $x^3 - 2^6$ cannot be positive.

3. See H. and K., par. 339. $x = 1$ or $-\frac{1}{3}$.

4. 36 minutes. From question, A's rate is 180 yards a minute for 5 minutes, and 160 yards a minute for remainder of time. B's rate is 165 yards a minute throughout.

5. Let X = quotient when P is divided by Q. Then $P = QX + R$. Let $Q = qF$ and $R = rF$ where F is a common factor of Q and R. Then $P = qFX + rF = F(qX + r)$, and F is also a factor of P. Again, let $P = pF'$ and $Q = qF'$ where F' is a common factor of P and Q. Then $R = P - QX = F'(p - qX)$, and F' is a factor of R. ∴ R and Q have the same common factors as P and Q.

Subtract $m^2 - n^2$ from $m^2 + n^2$. Remainder $= 2n^2$. This contains H.C.F. of the two expressions; and since m and n have no common factor except unity, if $m^2 - n^2$ and $2n^2$ have a common factor, it must be 2.

B. 1. See H. and S. definitions.

Let X and Y be given straight lines, Z the given ∠. Make ∠ ABC = ∠ Z. Cut off BA = X. With centre A, radius = Y, describe an arc. This may cut BC in two places, giving two △s, or may touch BC, giving one △; or if Y is less than perp. from A to BC, construction fails.

2. △s DAB, ABC are equal (I. 4). Hence ∠ ABE = ∠ EAB. ∴ EA = EB (I. 6). ∠s FAC, AFC are complementary. Also ∠ FAC = ∠ ABD (above), and ∠s ABD, ADB are complementary. ∴ ∠ AFC = ∠ ADB.

3. I. 43. Position of F for greatest area is point of intersection of diagonals. Take any other point, complete figure, and prove.

4. If the three points are in a straight line (II. 9 or 10). If A is not collinear with B and C (see H. and S., Ex. 24, page 147).

5. Bisect ∠ PQR by QT, meeting PR in T. Through T draw TS parallel to QR. Then ∠ STQ = ∠ TQR (I. 29) = ∠ TQS (constr.), and TS = SQ (I. 6). Similarly, TS = TR. ∴ QS = ST = TR.

X.

A. 1. See H. and K., par. 33.

2. (*a*) $4a^3b$, from $(a^3 \times -5ab) + (3a^2 \times 3ab)$. (*b*) $1 - x$.

3. (*a*) Treat two given expressions as difference of two squares, and factorise. ∴ $12(a + b + c)\,2(a - c) = 24(a - c)(a + b + c)$.

(*b*) $\frac{y^3 - 3x^2y - 4x^3}{(x+y)(x^3 - y^3)}$.

4. 22 per cent.

5. (*a*) $k = 1$. Extract root and obtain remainder. For perfect square this must be zero. Equate to zero, and $k = 1$.

(*b*) $x^2 - x + 1$.

B. 1. Sq. on AC = sum of sqq. on AB, BC (I. 47). Sq. on AD = sum of sqq. on AB, BC, CD—that is, = sum of sqq. on AC, CD. ∴ ∠ ACD is a rt. ∠ (I. 48).

2. If vertices of inner △ lie on sides of the other, this is an easy exercise on I. 20. If this is not the case, taking ABC, DEF for △s, produce EF to meet BC in G. Join GD. Produce to meet AC in H. Join HE. Produce to meet AB in K. Join KG. Prove by I. 20.

If inner quadrilateral is convex, theorem holds, but not necessarily if inner quadrilateral has a re-entrant angle.

3. (*a*) Let ABCD be the given quadrilateral. Join AC. Then △s ABC, CDA are equal (I. 8). Hence ∠ BCA = ∠ CAD. ∴ AD is parallel to BC (I. 27), and AB and CD are parallel (I. 33).

(*b*) ∠ ACB = ∠ ABC (I. 5). ∴ ∠ BCD > ∠ DBC or ∠ BDC, and BD > BC or CD (I. 19).

4. (*a*) II. 13.

(*b*) By above, $AC^2 + 2BD \cdot BC = AB^2 + BC^2$.

Similarly, $AC^2 + 2BF \cdot BA = BC^2 + AB^2$.

∴ BD . BC = BF . BA.

Also AC . AE = AB . AF, and AC . EC = CB . CD.

Now AC^2 = AC . AE + AC . EC (II. 2).

∴ AC^2 = AB . AF + CB . CD.

5. $PR^2 = PQ^2 - QR^2$ (I. 47) = $\frac{3}{4}PQ^2 = \frac{3}{4}LN^2$, since LN = PQ. $LN^2 = \frac{3}{4}LM^2$ ∴ $PR^2 = \frac{3}{4} \cdot \frac{3}{4}LM^2$, and PR = $\frac{3}{4}$LM.

XI.

A. 1. ± 16; ± 6.

2. If $(x - 1)$ is a factor, expression equates to zero on substituting 1 for x. (See H. and K., par. 229.) Other factors, $(x - 98)$ and $(78x - 7547)$.

3. Product of means = product of extremes.

∴ $(b + c)^2 - a^2 = a^2 - (b - c)^2$; that is, $b^2 + c^2 = a^2$.

4. (*a*) Take $x - 1$, x, and $x + 1$ for the numbers. Remaining factor = square of middle number increased by 2.

(*b*) Take x and y for digits, x being the greater, and simplify $(10x + y)^2 - (10y + x)^2$.

5. (*a*) $x = \frac{1}{3}$; $y = \frac{1}{3}$. (*b*) 0, 1, − 1, or − 2.

(*c*) $x = y = \frac{2a^2b^2}{a+b}$.

B. 1. ∠ APB > ∠ ACB (I. 16), and ∴ > ∠ ABP (hyp.). Hence AP < AB (I. 19). Drop AX perp. to BC. On XB cut off XD = XC. Then AP will be less than AC, when P lies between X and C. Prove.

2. Draw diagonals of rectangle, intersecting in E. Join PE, and produce to meet CD in F. Draw GEK at rt. ∠s to PF, meeting other sides in G and K. Join P, K, F, G. This is rhombus required.

3. On AB describe sq. ABCD. Bisect AB in E. Join EC. Produce AB to P, making EP = EC. Prove by II. 6 and I. 47.

4. AD = AE (hyp.). AD = BC (I. 34). ∴ AE = BC.
AC = AF (hyp.). AF = BE (I. 34). ∴ AC = BE.
Hence △s ABC, BAE are identically equal (I. 8).

∴ ∠ BAC = ∠ ABE, ∠ BAE = ∠ ABC, and AC and AE are parallel to BE, BC. But AF and AD are parallel to these (hyp.). ∴ AC and AF, also AD and AE, are in same straight line.

5. Take BC as base, 3 inches in length. With centre B, radius 2 inches, describe an arc; with centre C, radius 2·5 inches, describe another arc, cutting first arc in A. Join AB, AC. To find area, drop AX perp. to BC.

Area = $\frac{1}{2}$BC, AX. Obtain AX by I. 47. Let BX = m units in length, CX = n units, AX = p units. Then (I. 47) $m^2 = 2^2 - p^2$, $n^2 = (2{\cdot}5)^2 - p^2$. Hence $n^2 - m^2 = (2{\cdot}5)^2 - (2)^2 = \frac{9}{4}$; also $m + n = 3$. ∴ $m - n = \frac{3}{4}$, and $p = \frac{5\sqrt{7}}{8}$. ∴ area = 2·5 square in. (to 1 place).

XII.

A. 1. (*a*) Sum of roots = $-\frac{1}{4}$. Hence each root = $-\frac{1}{8}$. Also product of roots = $\frac{a}{4}$. ∴ $\frac{a}{4} = \frac{1}{64}$, and $a = \frac{1}{16}$.

(*b*) Sum of roots = 6, product = 7. ∴ equation is $x^2 - 6x + 7 = 0$. (See H. and K., par. 339.)

2. Let $\frac{a}{b} = \frac{c}{d} = k$. Then $a = bk$, $c = dk$. Subst. in given expressions.

3. Take $2x - 1$, $2x + 1$, $2x + 3$ for the numbers. Sum of squares increased by $1 = 12x^2 + 12x + 12 = 12(x^2 + x + 1)$, and is ∴ divisible by 12.

4. From (1) and (2), $3x - 5y - 2z = 0$.
From (2) and (3), $x - y - 4z = 0$.
Combining these, $2y = 10z$. ∴ $y : z = 5 : 1$.
Similarly, $x : z = 9 : 1$. ∴ $x : y : z = 9 : 5 : 1$.

5. Let x = one segment. Then $(m - x)$ is the other, and $x^2 + (m - x)^2 = n$. Solve this for x. Substitute values given. Lengths = 7 feet 7·75 inches and 2 feet 4·25 inches. Problem impossible when given line is greater than diagonal of square of n square feet area.

B. 1. (*a*) Locus is the line bisecting AB at rt. ∠s. Prove by taking points on it and using I. 4. Centre is the point of intersection of two loci. First when P is equidistant from A and B, second when P is equidistant from B and C.

2. Let ABCD = given rect., EF = given semi-perimeter. By II. 14 find a sq. = rect. ABCD. Bisect EF in G. On EF describe a semicircle. Draw perp. GK = side of square. Through K draw MKN parallel to EF, and meeting circumference in M and N. Draw NP or MP parallel to GK, meeting EF in Q or R. Then EQ, QF or FR, RE will be rectangle required. Prove by II. 5. Given perimeter must not be less than perimeter of square.

3. Draw DE at rt. ∠s to AC. △s ADB, ADE are equal (I. 26). ∴ DE = DB. But square on DC = twice square on DE (I. 47) = twice square on BD.

4. Angles at A, B, C are each $\frac{2}{3}$ of a rt. ∠. ∴ FE, FD, DE are straight lines. They are also equal, being twice side of given equilateral △. ∴ FDE is equilateral.

5. II. 12.
Draw PT perp. to QR. Then $PS^2 = PR^2 + RS^2 + 2TR, RS$.
Now 2TR = QR = RS. ∴ 2TR, RS = $RS^2 = PR^2$.
∴ $PS^2 = 3PR^2$.

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V.

Inference.—Inference or reasoning is the process by which from one or more propositions called *premises* we pass to a new proposition based upon them, the new proposition being called the *conclusion*. Thus from the proposition "All children are inquisitive," we obtain by inference "Some children are inquisitive," the truth of this proposition following as a consequence from that of the first. Where, as in this example, the conclusion is drawn from one premise, the inference is said to be *immediate*. *Mediate* inference is the obtaining of a conclusion from two or more premises, as in "All names are nouns," "John is a name," "therefore John is a noun." Here the two terms "John" and "noun" have been brought into relation by each being connected in turn in the premises with a third term "name." The inference is thus performed *mediately* through the intervention of this term.

Laws of Thought.—All thinking, in order to be valid, must conform to certain fundamental principles known as the laws of thought. They are three in number, and are as follows:—

1. *The Law of Identity.* This has been variously expressed as "A is A;" "Whatever is, is" (Jevons); "Whatever is true in one form of words is true in every other form of words which conveys the same meaning" (Mill). The law requires that the meaning of a term should not vary throughout a particular argument.

2. *The Law of Contradiction.* "A cannot both be B and not be B;" "Nothing can both be and not be" (Jevons). An attribute cannot be both present and absent at the same time.

3. *The Law of Excluded Middle.* "A either is or is not B;" "Everything must either be or not be" (Jevons). A certain attribute must be either present or not present—for example, paper must be either white or not white; there is no middle course between contradictories.

Immediate Inference.—There are many forms of immediate inference, the chief being—(1) inferences of *opposition*, (2) *obversion*, (3) *conversion*, (4) *contraposition*. It will be necessary to consider these in detail.

Opposition.—Propositions are said to be *opposed* when they have the same subject and predicate, but differ in quantity or quality, or both. To illustrate this, let us frame a proposition with the same subject and predicate in each of the four classes A E I O; for example—

A. All men are happy.
E. No men are happy.
I. Some men are happy.
O. Some men are not happy.

By the definition, any pair are in opposition. An examination of the relations existing between any two of them shows that they are of four kinds, which have been named as follows:—

1. *Contrary Opposition*, the relation existing between an A and an E proposition having the same subject and predicate. Such propositions are said to be *contraries*. Evidently both cannot be true; hence if one is true, we may immediately infer the falsity of the other. But from the falsity of a proposition we cannot infer the truth of its contrary, for both may be false. Note that contraries are of the same quantity; they are both universal, but they differ in quality.

2. *Contradictory Opposition*, the relation between a universal and the particular of opposite quality having the same subject and predicate—that is, between an A and an O, and between an E and an I proposition. Both cannot be true, nor can both be false. Not only can we infer from the truth of one the falsity of the other, but from the falsity of a proposition we can immediately deduce the truth of its contradictory. The opposition is therefore more complete than that existing between contraries.

3. *Sub-contrary Opposition*, existing between an I and an O proposition having the same subject and predicate. In this case both of the propositions may be true, but both cannot be false. Opposition does not therefore here imply inconsistency, since both may be true together.

4. *Subaltern Opposition*, existing between a universal proposition and the particular of the same quality having the same subject and predicate—that is, between an A and an I, and between an E and an O proposition. Here, again, *opposition* does not denote inconsistency, for the truth of the universal necessitates the truth of the particular. In this relation the universal is called the *subalternans* or *subalternant*, and the corresponding particular its *subalternate*. Given the truth of the universal, we infer the truth of the particular; but from the falsity of the universal, we can infer nothing as to the truth or falsity of the particular. Again, the denial of the particular involves the denial of the universal, but from the truth of the particular we cannot infer the truth of the universal.

The square of opposition is a diagram symbolising the relations named above. With its aid, students will find little difficulty in remembering the various kinds of opposition.

Obversion is a process of immediate inference in which we pass from an affirmative or negative proposition to the implied negative or affirmative, the new proposition being called the *obverse* of the original proposition. The rule for obversion is, "Negative the predicate and change the quality." Thus the obverse of "All men are mortal" is "No men are not mortal;" "Some stories are true," obverted, becomes "Some stories are not untrue;" "No planets are luminous" changes to "All planets are non-luminous;" and "Some men are not reliable," to "Some men are unreliable." An A proposition obverts to E, E to A, I to O, and O to I.

Conversion is an inference from one proposition to another by transposing its terms. Thus, from "Some teachers are athletes," we can infer by conversion "Some athletes are teachers," the second proposition being called the *converse* of the first. We cannot, however, always obtain a true proposition by merely transposing the terms; it is not a valid inference from "All soldiers are males" to conclude "All males are soldiers." Here we violate one of the two fundamental rules of conversion, which are as follows:—

1. The quality of the proposition must remain unchanged.
2. No term must be distributed in the converse which was not distributed in the convertend.

In the example given above, "males," which is undistributed in the convertend, is distributed in the converse, and so Rule 2 is broken. To obtain a true inference by conversion from an A proposition, we must keep the predicate in its undistributed condition, so that the converse of "All soldiers are males" is "Some males are soldiers;" "All S is P" becomes "Some P is S." A is thus converted to I, the process being called *conversion by limitation*, or *per accidens*.

E propositions are simply convertible; thus, "No women are members of Parliament" becomes "No members of Parliament are women." I propositions, as was illustrated in the first example, are also convertible by simple transposition of terms.

O propositions cannot be converted. Consider the general form of an O proposition, "Some S is not P." The converse should be "Some P is not S;" but then we distribute S in the converse, although it was not distributed in the original proposition—that is, we break the second rule of conversion.

Conversion which is a valid inference is called *illative conversion*.

Contraposition is an inference in which we make the contradictory of the predicate of the original proposition the subject of a second proposition, which is called the contrapositive of the first. The rule for the process is, "First obvert and then convert." Thus, the contrapositive of "All wise men are just" is "No unjust men are wise," for by obversion we get "No wise men are unjust," and by conversion this becomes "No unjust men are wise." A, E, and O propositions admit of contraposition, but not I; for an I proposition by obversion becomes O, and we have already seen that an O proposition cannot be converted.

QUESTIONS.

(Students can have their exercises corrected by sending them with seven stamps to The Editor, Logic Course, PRACTICAL TEACHER.)

1. What are the laws of thought? In what sense are they laws?

2. Define inference. Distinguish mediate and immediate inference.

3. What are the various forms of opposition? Which of them has the greatest value, and why?

4. Draw as many inferences as you can from each of the following propositions by means of the doctrine of opposition:—
(1.) No planet is self-luminous.
(2.) All delays are dangerous.
(3.) Some kings are absolute monarchs.
(4.) Some students do not fail in anything.

5. Explain, and illustrate by examples, the difference between the "converse" and the "contradictory" of a proposition. When, and under what conditions, is or is not the converse necessarily true?

6. Give in succession the obverse, the converse, the subaltern, the contrary, and the contrapositive of "All trespassers will be prosecuted."

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TEST QUESTIONS ON LAST MONTH'S WORK.

Theory of Teaching.

1. Compare a bad method and a good method of teaching geography. Show the connection of geography with history, and illustrate by any event which necessitates the knowledge of both subjects. (Certificate, 1894.)

2. How would you encourage a child to work for himself in studying the elements of (*a*) geography and (*b*) English history? Briefly describe any devices that seem to you appropriate to these two purposes respectively. (Certificate, 1901.)

3. Describe some form of closed stove suitable for school use with which you are acquainted, and summarise the advantages and disadvantages of closed stoves as compared with open fireplaces.

English Language and Literature.

1. Give examples of words that have been introduced into English through commerce.

2. Quote any sayings of Dr. Johnson that struck you as noteworthy in the portion of the "Tour" you have studied.

3. Explain the following:—*The hour of death is expiate; statuas; her royal stock graft; presently; retailed;* and *attainder of suspect.*

English History.

1. Compare the parts played by Wallace and Bruce in the wars for Scottish independence.

2. Give an account of the chief legislative enactments of the reign of Edward the First.

Geography.

1. Compare the river systems of Asia with those of Europe.
2. Give an account of the areas of inland drainage in Asia.

Algebra.

1. Solve the following equations:—

(1) $\frac{x}{x-1} + \frac{x-1}{x} = \frac{13}{6}$.

(2) $x^2 + 2(b-c)x + c^2 = 2bc$.

(3) $\frac{1}{x-2} + \frac{2}{x-1} = \frac{6}{x}$.

2. A number consists of two digits, one of which is treble the other. Another number is formed from the first by reversing the digits. The difference between the numbers is equal to 18. Find the numbers.

Elementary Science.

1. How could you tell whether a given liquid was water? What effects would be produced (*a*) by mixing alcohol with water, (2) by dissolving salt in it?

2. How can pure water be obtained from sea-water?

3. What is meant by "hard water"? Describe some methods of softening hard water.

NOTES AND SYLLABUS FOR DECEMBER.

English Composition.

Study carefully Nichol, Part III., chaps. iii. and iv. The student must be very careful to avoid ambiguity in writing, for it is a fault that is easily committed. If a passage admits of two constructions, it frequently happens that it conveys one meaning to the writer and quite another meaning to any one else who reads it. Hence, in reading through your essays when you have finished them, do not be content with asking whether each sentence means exactly what you intended it to mean, but be sure also that it cannot mean anything else as well.

Prepare essays on—

1. Thrift.
2. International Arbitration.
3. The Advantages of Education.

Theory of Teaching.

Prepare the first part of the chapter on teaching arithmetic, pp. 214–256. The general introduction to the subject of mathematical teaching is extremely important, and it is essential that the principles underlying the teaching of the earlier rules should be thoroughly mastered. If our readers have not been in the habit of teaching subtraction by the method of "complementary addition," and long division by the Italian method, we strongly advise them to put these methods to the test of a trial with their classes, and let us know whether the children do not acquire both a surer knowledge of what they are doing and a more rapid and accurate way of working their examples.

School Hygiene.—In order to prevent overcrowding, the Code lays down a space of 10 square feet as the minimum that must be provided for each child. Each classroom should have a card on the door stating its length and breadth; the product of these numbers will give the area of the floor, from which the accommodation can be deduced by division. At first the student may think that a space five feet by two is rather in excess of the requirements; but when allowance is made for the gangways between the desks, and for the large space needed in front of the class, it will be seen that this is none too much. The student can easily sum up the evils of overcrowding under two heads—(*a*) want of room to move freely, and (*b*) difficulty of keeping the air pure.

Posture.—The syllabus very properly calls the student's special attention to this matter. Far too little heed is paid to the posture taken up by children when doing class-work. One common error is to make them spread their left arms round their books or slates so as to prevent their work from being seen by their neighbours. This throws the left shoulder a great deal too much to the front, and produces a cramping effect on the chest and down the left side. Many children are allowed to put their eyes too close to their work, and thus ruin their eyesight. The eyes should be twelve or at least ten inches away from the work. Any posture which allows a shorter distance is bad. Another ill effect of putting the eyes too close is seen in the cramped chests and round shoulders of those who have been allowed to get into the habit.

Play and Games.—The advantages of a break during a long session of work are obvious. A few minutes' free exercise in the open air relieves muscles that have got cramped from overwork, and gives play to those that have been kept unduly inactive. This quickens the circulation of the blood, which now finds a supply of pure air in the lungs. Moreover, the mind is rested and refreshed by this play in a way that it cannot be when bodily exercise takes the form of drill. The teachers should always be in the playground at playtime, to supervise the pupils, and to encourage them in their play. The moral effects arising from organised games cannot be overlooked. Boys learn to select their own captains and to obey them, and acquire the habit of winning without needless exultation, and of taking defeat with an even mind, both of which are very valuable in after-life. Most games supply a very important "hand and eye training," which is often ignored by advocates of cardboard cutting, etc. Skipping, rounders, cricket, and football require certain bodily movements to be made in accordance with certain altering conditions learned through the eye; in the case of marbles, peg-top, and "konkers," the conditions are unchanging, but still a very large amount of judgment is required to be able to exert the right amount of force, and to exert it in the right direction.

English Literature.

Read Boswell's *Tour to the Hebrides*, pp. 108–214—that is, to the account of Sunday, 3rd October. Mark sections for further perusal, and make a collection of sayings that are worth committing to memory.

Study in detail *Richard III.*, Act IV.

Scene i., line 38. *This dead-killing news.* The demonstrative "this" shows that "news" is in the singular. Of course the adjective "dead-killing" is pleonastic, but it marks the queen's strong feelings.

54. *Whose unavoided eye is murderous,* whose eye causes death unless it be avoided.

87. *I pity thy complaining,* I am sorry for the cause of your complaint.

97. *Teen,* agony or grief.

Scene ii., line 10. *Think now what I would say.* Richard tries to make it appear that Buckingham is also planning the crime.

35. *Close exploit,* a secret deed.

81. *By this token.* There should, probably, be a stage direction that Richard "gives Tyrrel a ring."

93. *The earldom of Hereford.* As every reader of *Richard II.* will remember, Henry the Fourth was Earl of Hereford before he was banished; and Holinshed tells us that on this account Richard the Third did not want to keep his promise to make Buckingham

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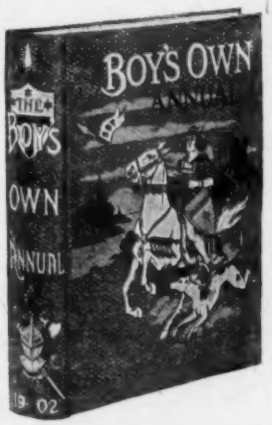

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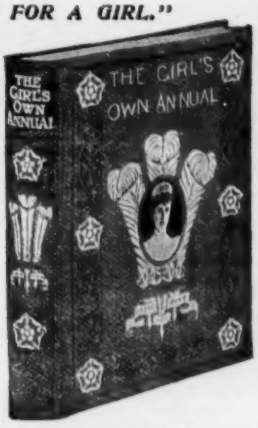

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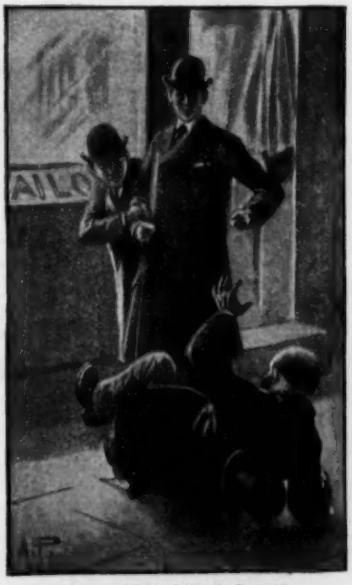

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Earl of Hereford, lest it might seem to be an acknowledgment of Buckingham's royal descent, and an inducement to claim the crown later on.

111. *Richmond* is a corruption of Rougemont, which means Red-mount or Red-hill. Richmond, in Yorkshire, is so called because it stands on a red hill. It gave the title of earl to Henry, and the name was transferred to Richmond, in Surrey (formerly called Sheen), where there was a royal palace.

Scene iii., 1–23. The description of the little princes is extremely beautiful, but rather too poetical for the lips of the men who had murdered them.

40. *The Bretagne Richmond.* The Earl of Richmond had been staying in Brittany, or *Bretagne* as it is spelt in French.

Scene iv., line 5. *A dire induction*, a terrible beginning. "Induction" meant much the same as "introduction" or "preface." Compare I. i. 32,—

"Plots have I laid, inductions dangerous."

It is in contrast with "consequence" in the next line.

20. *Quit*, balance, or compensate for.

21. *A dying debt*, a debt that can be paid only by dying.

35. *Reverend*, worthy of respect. The suffix *-end* comes from the ending of the Latin gerund, a part of the verb that implies fitness or necessity of being the object of an action. (Compare *dividend, subtrahend, multiplicand.*)

36. *Seniory* = seniority.

100. *Caitiff*, a doublet with *captive*, from Lat. *captivus.*

120. "By thinking those you have lost better than they actually were, you make him who caused your loss seem so much the worse."

127. *Attorneys, client:* An attorney is one who is empowered to speak or act for another. The latter is called his client.

128. *Intestate*, dying without having made a will.

142. *Owed* = owned.

168. *Tetchy and wayward*, irritable and self-willed.

199. *No moe sons* = no more sons.

202. *Level not*, do not aim, do not prepare; as a knight when preparing to strike levelled his lance.

222. *Cozened*, cheated. There is a play on the words "cousins.....uncle cozened."

229. "If it were not that the continued endurance of grief modifies the wildest grief."

247. *Demise*, to leave by will.

250. *So* = on condition that. Lethe is the river of forgetfulness.

292. "Men must act unadvisedly sometimes, and after a time they repent of what they have done."

335. *Cæsar's Cæsar*, the conqueror of the conqueror.

346. *Which* = who. "Which" is not used in modern English in speaking of persons.

463. *White-livered runagate* = cowardly vagabond.

English History.

Prepare the reigns of Edward the Second, Edward the Third, and Richard the Second.

Edward II.—Abandonment of war against Scotland. Progress of Bruce in Scotland. Edward leads an army to defeat at Bannockburn. The Scotch attack the English both in England and in Ireland. Successes of Edward Bruce in Ireland. His final defeat and death.

State of Ireland. The English cause weak on account of the turbulence and degeneracy of the Anglo-Norman nobles there, and of the system of ruling by deputies. Great effort of the native Irish, under Phelim O'Connor, to recover their independence, and their crushing defeat at Athunree. Edward's neglect of his queen makes her join the insurgent barons against him and the Spensers. Death of the latter. Deposition and death of the king.

Other points to be studied are:—The abolition of the order of Knights Templars; the subserviency of the Pope (who lived at Avignon instead of Rome) to Philippe le Bel, King of France; and a biography of William of Ockham.

Edward III.—This reign is one of the most popular and best known in English history. Perhaps the social history of the period is least known. After the Black Death (1349), which carried off many thousands of the working-classes, the Statute of Labourers was passed, to compel labourers to work for a stipulated sum. This was the beginning of a system of class legislation which continued for many years.

The campaigns in France must be followed *with the help of a map.* The treaty of Bretigny marks the summit of Edward's fame; after that the English met with repeated defeat abroad, and the king's conduct was anything but creditable at home. A biography of Duguesclin, who led the French in their successful struggle, should be read. Other biographies to be studied are those of William of Wykeham, Bishop of Winchester, chancellor of the kingdom, architect and founder of Winchester College, John Wyclif, and John of Gaunt. The latter was responsible for much of the misgovernment during the dotage of Edward the Third. The Black Prince headed a party of reform, and some of the ministers were impeached, and thus was established the procedure of parliamentary impeachment. After the death of the Black Prince, the Duke of Lancaster again came into power, and for the few remaining months of his father's life his rule was arbitrary. Courtenay, Bishop of London, withstood him; but trouble arose when Wyclif was accused of heresy by the bishop, and Lancaster sided with Wyclif.

Among the constitutional enactments were:—(*a*) The Statute of Treasons; (*b*) The Statute of the Staple; and (*c*) a statute ordering English to be considered as the official language. Acts of treason were of two kinds—attacks on the king's person, and assumption of royal power. The term treason had, however, been extended to cover attacks on the king's near relatives, and in the twenty-first year of Edward's reign a man was tried for treason for simply detaining another man until the latter had paid him a sum of money. This exercise of dominion over another was reckoned an assumption of royal prerogative. The House of Commons immediately petitioned the king, and an Act was drawn up stating exactly which offences could be counted treasonable. The Statute of the Staple (that is, market) regulated the places and manner of holding markets.

Richard II.—The condition of the working-classes must be carefully considered in dealing with this reign. The power of the House of Commons was shown by its successful demand that all money voted for the war should be placed in the hands of commissioners specially selected and sworn in Parliament. In the next Parliament, the Commons demanded that these accounts should be submitted to them; and although the king's ministers objected, the accounts had to be submitted for audit, and such was the evident power of the Commons that the next year the ministers submitted the accounts without waiting to be asked for them, and this in spite of the fact that on the former occasion they had protested that the accounts were produced purely as an act of grace on the king's part.

This power was still more plainly shown by the impeachment of the Earl of Suffolk, Richard's chancellor. The constitutional importance of this trial cannot be exaggerated, for it establishes the responsibility of ministers to the people, and the inability of the king to screen an offending officer.

In this reign we find one of the king's uncles, the Duke of Gloucester, placing himself at the head of the parliamentary party as opposed to the court party; and although the aims of the two great political parties into which English statesmen have been divided have undergone great modifications, we can see in this formation of parties in the reign of Richard the Second that division which persisted through the Wars of the Roses, the Civil War of Charles the First, and the times of Whigs and Tories, down to the Liberals and Conservatives of our own time.

The tyrannous behaviour of Richard after he came into possession of his real power, and the events leading up to his deposition and death, are generally well known. In this reign the severity of the old Forest Laws was diminished, and the first general Game Law passed. It also saw the introduction of the title of marquess, and the custom of conferring peerages by letters patent.

Geography.

Study carefully the geography of India. Draw a map and mark in the physical features. Observe that the mountains lie mainly round the border. The mountains at the north form a strong natural frontier, which is weakest, however, at its western extremity. Several times India has been invaded from the north-west. Contrast the great plains of the Ganges and Indus, noting that the former is extremely fertile, except in Terai, and has a dense population; the latter contains many deserts, and is scarcely productive except along the banks of the rivers and canals. The Punjaub, the most fertile part of the basin of the Indus, is much drier now than formerly, as is shown by the dry and disused river-beds. With regard to the rivers themselves, notice that the Indus is not well suited for traffic, while the Ganges with its tributaries forms an admirable system of communications, and has many important towns on its banks.

The general question of periodical winds should be studied with care, in order to get a clear idea of the nature of monsoons. A full account in a text-book of physical geography should be read, and if the student will only move a piece of chalk over the surface of a revolving globe, he will soon arrive at a clear conception of the effect of the combined motion of the earth and air. The south-west monsoon blows in summer, and the north-

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west in winter; the former brings heavy rain-clouds which water the West Coast Plain and the Western Ghâts and the valley of the Ganges. At Mahabaleshwar in the Western Ghâts the rainfall reaches 250 inches a year, while in the Khasia Hills in Assam it reaches 600 inches a year—making this the wettest spot on the globe.

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Arithmetic.

The theory of ratio and proportion must be thoroughly mastered. When students get to this stage, they seem to have a dread of not being able to make *statements* enough. In working ordinary multiplication, the beginner who is asked how much 6 yards will cost at 3s. 4½d. per yard never dreams of making a statement, but knows that 6 times as many yards will cost 6 times as much money, and straightway proceeds to multiply by 6. But the more advanced student who is asked to find the cost of 5 yards if 6 yards cost £1, 0s. 3d., surely knows that ⅚ of the number of yards will cost ⅚ of the money; and he should therefore multiply £1, 0s. 3d. by ⅚. There is no necessity to write down "statements," either with or without dots. We may consider proportion as consisting of two steps—(1) finding the multiplier, generally a fraction; and (2) multiplying by it. It thus consists of two operations learnt while studying fractions, but which are generally treated as so much labour for nothing.

Example.—A field of 10 acres is ploughed in 1 day 3 hrs. 50 min. Find how long it would take to plough 56 acres 2 roods 16 poles. (A working day consists of 8 hours.)

(Certificate, 1901.)

Since 56 ac. 2 ro. 16 po. is $\frac{56 \text{ ac. } 2 \text{ ro. } 16 \text{ po.}}{10 \text{ ac.}}$ *of 10 ac., it will take* $\frac{56 \text{ ac. } 2 \text{ ro. } 16 \text{ po.}}{10 \text{ ac.}}$ *of the time required for 10 ac. to plough it.*

$$\frac{56 \text{ ac. } 2 \text{ ro. } 16 \text{ po.}}{10 \text{ ac.}} \text{ of } 11\tfrac{1}{2} \text{ hrs.} = \frac{56{\cdot}6}{10} \text{ of } \frac{71}{6} \text{ hrs.}$$

$$= \frac{4018{\cdot}6}{60} \text{ hrs.} = 8 \text{ days } 2 \text{ hrs. } 58{\cdot}6 \text{ min.}$$

The explanation we have here given in italics is not to be put down, any more than the reasoning by which a child comes to the conclusion that 6 yards is 6 times as much as 1 yard, before he proceeds to multiply by 6.

Work plenty of examples, so as to become thoroughly familiar with this view of proportion.

Algebra.

Read carefully the chapter on the theory of quadratics. The following theorems are perhaps the most important:—

1. A quadratic equation cannot have more than two roots.

2. If a quadratic expression is equal to zero, the sum of the roots is equal to the coefficient of the second term divided by the coefficient of the first with its sign changed, and the product of the roots is equal to the last term divided by the coefficient of the first.

Take, for example, $ax^2 + bx + c = 0$; then the sum of the roots of this equation is $-\frac{b}{a}$, and their product is $\frac{c}{a}$. In the particular case in which $a = 1$—that is $[x^2 + bx + c = 0]$—the sum of the roots is $-b$, and the product is c.

Study the conditions under which the roots of the equation will be equal, real, imaginary.

In practice it is well to be familiar with the following three methods of working.

1. Reduce to the general form $ax^2 + bx + c = 0$, then factorise the expression on the left-hand side, and divide both sides of the equation by each factor separately.

Example:—

$$x^2 - 15x + 56 = 0;$$

that is,

$$(x - 7)(x - 8) = 0.$$

$\therefore$ if we divide by $x - 7$, we obtain $x - 8 = 0$; and if we divide by $x - 8$, we obtain $x - 7 = 0$.

From the first of these we have $x = 8$, and from the second $x = 7$.

2. Reduce the general equation $ax^2 + bx + c = 0$ to the form $x^2 + \frac{b}{a}x = -\frac{c}{a}$, and make a complete square of the left-hand member by adding $\left(\frac{b}{2a}\right)^2$ to each side, and then extract the square root. After dealing with many examples with numerical coefficients in this way, apply the method to the equation $ax^2 + bx + c = 0$. From this you will obtain the formula—

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

3. Solve equations by means of this formula. Like all other formulæ, it should never be used by any one who is not able to prove it; but every student should make himself familiar with the proof of it, and employ it for every equation which presents any difficulty in factorising. If the equation factorises easily, the first method is the best. In any case the second is cumbersome.

Euclid.

Prepare Book III. to end of Prop. 26.

Elementary Science.

The subjects put down in the second section of physiography are not really difficult, but on account of their abstract nature they appear to be so. It is necessary to make quite sure of the first principles, and speaking generally, the text-books are too disposed to take for granted that the student's ideas are quite clear when they are not.

Matter in Rest and in Motion.—We have already dealt with matter and its various forms; now we have to consider matter in reference to its position. The terms "position," "rest," and "motion" are so commonly used that few people ever trouble to inquire what is their exact signification. Now we must realise first that all position is relative. A body has position only with respect to the position of other bodies. This important fact will be realised by attempting to describe the position of any object. We at once use such expressions as "on the table," "near the fire," or in geography we give latitude and longitude—that is, refer to the position of two fixed lines on the earth's surface. It follows from this that if there were only one body in infinite space, that body could have no position, for there would be no other bodies to which its position could be referred.

If the position of a body remains unaltered during the time we are considering, we say that the body is at rest; but if its position changes, we say that it has moved. Motion is change of position. It will be seen that if there were only one body in the universe we could not say that it moved, because it could not change (or keep) its position, as we have seen above that it could have no position.

A body may move in a variety of ways. It may move as a whole—that is, the position of the whole body may change with respect to surrounding objects—for example, a moving train, a falling stone; or the whole body may keep the same position with respect to other bodies, while the position of its parts may change—for example, a spinning top, a moving wheel.

It follows from this that a body may change its position with respect to some bodies, but not with respect to others. In this case we are equally correct in saying that the body is either at rest or is moving. Thus a box on the seat of a railway carriage is at rest with respect to the parts of the carriage, but with respect to the things outside the train it is in a state of motion.

The question is often asked whether the moon revolves on its axis. Some people say "Yes," and others say "No;" and both may have an accurate idea of the facts of the case, for since the moon always keeps the same side towards the earth, it *does not rotate with respect to the earth*. But since a spectator outside the moon's orbit would have the different parts of the moon turned towards him in succession, *it does rotate with respect to objects outside its orbit*. We see, then, that a statement concerning the condition of rest or motion of a body is not complete, unless the positions of the bodies to which the position of the first is referred are defined or clearly implied. As a further illustration of this subject, we will conclude with the following Christmas puzzle:—

A gentleman going to post a letter found a monkey seated on the top of the pillar-box. The gentleman then proceeded to walk round the pillar-box, but the monkey adjusted his seat so as always to face the gentleman. Did the monkey turn round?

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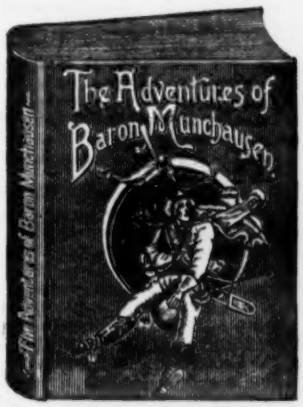

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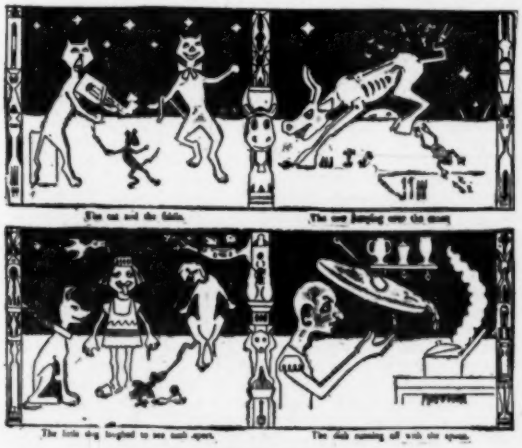

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PHYSIOGRAPHY.

(ADVANCED AND HONOURS.)

Fall of a 10 lb. Meteorite in Ireland.—There recently fell at Crumlin, Co. Antrim, a notable meteorite. Mr. Walker of Crosshill, in whose land it fell, says that it was quite hot on falling, and felt warm for more than an hour afterwards. Mr. John Adams, one of Mr. Walker's servants, says that he was startled by a loud noise as of a boiler bursting, followed by another noise as of escaping steam, and a cloud of dust appeared above the standing corn. Fetching a spade, Adams went to the spot, and after a quarter of an hour dug up a black, dense stone which had penetrated the soil to a depth of 1½ feet, and had there been stopped by a stone much larger than itself. The stone weighs 9 lbs. 5½ oz., and $7\frac{1}{2}'' \times 6\frac{1}{2}'' \times 3\frac{1}{2}''$ are its dimensions. The meteorite is covered with the crust that is formed during the passage of such bodies through the air, and has all the characteristics of a true meteorite, which it undeniably is. Owing to the presence of particles of nickel iron dispersed through the stony matter, the meteorite affects the magnetic needle. It is the largest stone which has been seen to fall from the sky to the British Isles for eighty-nine years, and is larger than any which have fallen in England itself since the year 1795.

Search for an Intramercurial Planet.—In Bulletin No. 24 of the Lick Observatory, Professor Perrine describes the photographic search for the intramercurial planet which, according to Leverrier and others, might be the disturbing influence that causes the considerable motion observed in the line of apsides of the orbit of Mercury.

Reduction of the negatives obtained during the 1901 eclipse has led to a negative result. There is just a possibility that at the time of the eclipse the hypothetical planet may have been in a direct line with the bright corona, and so have escaped notice; but as the corona only covered $\frac{1}{1000}$th of the area photographed, this is scarcely probable. A planetary body 34 miles in diameter would have appeared as having a magnitude of 7½ in the existing circumstances, and as it would need 700,000 such bodies, each having the same density as Mercury, to produce the observed movement in the orbit of the latter, it seems highly improbable that these changes are due to the interference of an intramercurial planet. Professor Perrine suggests that perhaps the finely-divided matter which produces the zodiacal light may, when considered in the aggregate, be sufficient to cause the perturbations in the orbit of Mercury.

Variations of Terrestrial Magnetism and the Chromosphere.—The discussion of the connection between the variations of terrestrial magnetism and solar activity has chiefly been confined to comparisons of magnetic phenomena with sun-spots, and it is well known that while the diurnal range corresponds closely with the sun-spot cycle, a difficulty has arisen from the fact that a great sun-spot may or may not be accompanied by a magnetic storm. Sir Norman Lockyer has recently investigated the magnetic variations in relation to the observations of the chromosphere, and prominences made by the Italian observers during the last thirty years, and has concluded that the epochs of great magnetic storms correspond with those of the greatest disturbances of the chromosphere near the sun's poles, while the general magnetic curve agrees closely with that of prominences observed near the solar equator.

The Great Red Spot of Jupiter.—Mr. G. W. Hough writes of the great red spot of Jupiter, which he has carefully studied for so many years, in *Popular Astronomy*, as follows:—For 1878 to 1879 I found the rotation period given by the red spot to be 9 h. 55 m. 33·7 secs. It reached its maximum value in 1899—namely, 9 h. 55 m. 41·68 secs.; since the latter date the spot has had a direct drift, with accelerated velocity. For 1900, rotation period was 41·50 secs.; 1901, 41·01 secs.; and for 1902 the rotation period will probably be 3 secs. less than for 1899. The motion of the red spot in latitude and longitude is of great interest. During twenty-one years the retrograde drift increased the rotation period 8 secs.; the maximum drift occurring in 1881, when the change in rotation period between successive oppositions amounted to 1·5 secs. From observations made by Gledhill on the red spots in 1869–70, a rotation period of 9 h. 55 m. 25·8 secs. has been determined, from which it would appear that the cycle in the motion of the red spot is a very long one.

The red spot has a drift in latitude as well as longitude. The equatorial belt both north and south of the equator, however, has a much greater drift in latitude; hence it is concluded that the red spot lies at a lower level than the belt.

What the Red Spot is.—Mr. Hough argues that, from its great permanency, it is not a simple surface, but has a depth equal to its breadth, in which case its volume would be approximately three times that of the earth. The superficial density of the surface of the planet is probably between 0·4 to 0·5 of that of water. The variation in rotation period given by spots and markings on the surface is best explained by assuming them to lie at different levels in the medium which constitutes the surface of the planet. Over this surface there may be an extensive atmosphere of a density comparable with our own.

Nova Persei.—At a recent meeting of the Royal Society, Sir N. Lockyer read a paper on the effects of pressure on the spark discharges from metallic substances, which had an important, though indirect, bearing upon the interpretation of the phenomena exhibited by the new star in Perseus, and previously by that in Auriga. Here certain of the bright lines in the spectrum were found to be associated with absorption lines on their more refrangible sides. This appearance he had attributed to the presence of two bodies moving with a very great relative velocity, one causing a radiation, the other an absorption spectrum. This interpretation had been questioned, results of experiments being quoted as adverse, and it had been suggested that the pairs of lines were more probably due to high pressure. In order to test this hypothesis, the author had made experiments with iron, silver, lead, copper, zinc, and magnesium under water, by means of which certain experimental difficulties were avoided, and very high tensions obtained when electric sparks were discharged. The results proved to be very different from those observed in the spectra of the two stars, thus demonstrating that whatever may be the cause, it cannot be that which produces the appearances presented in the spectrum of the spark in water.

The Temperature of the Atlantic.—For the month of September, 4,300 observations of North Atlantic sea-surface temperatures show that nearly the whole of the area northward of the 48th parallel was warmer than the average, while between 30° and 48° N. there was a deficiency. In the immediate vicinity of the British Isles there was a slight defect, the air temperature over the land having been from 1° to 3° below the average.

Kite Meteorology.—Recently kite-flying, from being a mere pastime, has become a serious occupation to scientists anxious to know something more about the upper strata of the atmosphere. Hitherto the best performances as regards sending self-registering instruments to great heights have been accomplished in America; but now that other countries are flying their kites, still better results may be expected. This year in Scotland kites were sent to a height of 11,450 feet, 21,350 feet of wire being run out. To draw in a kite from such an elevation an engine and a winder are of course necessary, to say nothing of the wire and the instruments, so that at present flying kites is as expensive as keeping a motor-car.

Foucault's Pendulum Experiment.—The great pendulum which had been hung from the top of the dome of the Panthéon by the Astronomical Society of France, to give ocular demonstra-

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tion by its oscillations of the rotation of the globe, was on Wednesday week set in movement at a ceremony presided over by M. Chaumié, Minister of Public Instruction. The pendulum consisted of a ball weighing about 60 lbs. attached to a wire about seventy yards long. The president was received by M. Poincaré, member of the Institute and of the Bureau of Longitudes, and M. Camille Flammarion, president of the Astronomical Society. M. Flammarion, after reminding his hearers that it was in 1661 that the demonstration was first made in Florence by Galileo, referred at considerable length to the memorable experiment made in France by Foucault half a century ago, and of which the present was a repetition. M. Chaumié commented on the technical explanations given by the astronomer, and then, by burning with a match the string which held it, freed the pendulum, which commenced its majestic oscillations. Sand was placed on the floor, and each time the pendulum passed over it a new track was marked by the stylet in regular deviation, though the plane of the swing of the pendulum remained unchanged. The experiment was completely successful.

October Rainfall.—Over the metropolitan area the total rainfall for the month was only an inch and a half, the deficiency being an inch and a quarter. The sunny hours also were greatly short, amounting to only twenty-nine, or forty-two less than the normal.

The Earth's Internal Heat.—Various suggestions in the past have been made as to new sources of energy, ranging from electricity to liquid air, but a proposition to tap the earth's internal fires is seriously put forward in the last issue to hand of the *Boston News Bureau* by the official geologist for Pennsylvania of the United States Geological Survey, and Professor Hallock of Columbia University, New York. Starting on the basis that the average rise of temperature in the earth is about one degree in every 50 feet below the earth's surface, it is argued that the temperature at the bottom of a well 9,720 feet deep at Harrisburg, Pennsylvania, would be 212° Fahr. Thus, if cold water was poured into this well, it would at once be turned into steam. As, however, the steam would partly cool before reaching the surface, no matter how rapid the speed, it is considered that it would be necessary to sink the well to a depth of about 10,000 feet. In confirmation of the theory, it is pointed out that water left overnight in the deepest wells in Pittsburg, Pennsylvania, becomes hot, and if there were some method to force it up rapidly it could be utilised.

This is the view of the official geologist, but the professor at the Columbia University goes one better. He suggests that if a second hole were sunk to connect at the bottom with the well, and a charge of dynamite exploded so as to form a water reservoir there, the cold water could be kept pouring into the bore, which would force the hot water and steam up the orifice of the well. The steam, it is calculated, from a 10,000 feet hole would reach the surface with a pressure of at least 5,000 lbs. to the square inch. The professor says: "Less than twenty years ago the bare idea of drilling a hole 10,000 feet in depth would have been considered chimerical; but if they can sink a shaft 6,000 feet at a copper mine in Northern Michigan—which will be an accomplished fact in a few months—surely a way can be devised to bore down 10,000 feet, or 12,000 feet if necessary. With a 5-inch steampipe and a pressure of 5,000 lbs. to the square inch, over 125,000 lbs., enough steam and hot water could be sold to bring in 100,000 dollars yearly."

CHEMISTRY.

(ADVANCED AND HONOURS.)

BY T. CARTWRIGHT, B.A., B.SC.

Electrolysis of Water.—Messrs. Chapman and Ledbury give an account of some interesting work on water electrolysis. A series of electric sparks are allowed to pass between two platinum wires sealed into a glass tube, through which a current of water vapour is drawn. As a result of the examination of the gases from the anode and kathode respectively, the authors conclude that the separation of the constituent elements of water from water vapour is not entirely due to a process of electrolysis. If it were, hydrogen should appear at one electrode and oxygen at the other, whereas hydrogen collects at both electrodes. The quantities of the separated gases should, moreover, not exceed those of the oxygen and hydrogen, which collect in a voltameter placed in the same electrical circuit; whereas the experiments show that, under certain conditions, the quantity of hydrogen from the water vapour which collects at the kathode is five or six times as large as that which separates in the voltameter.

Some Useful Memoranda.—Too often the student of chemistry ignores the fact that in studying the metals, their oxides and salts, much time can be saved and much laborious memorising be avoided by a comparison of the methods, of which there are but a few, whereby these bodies may be prepared. It is to draw attention to this, and to assist the student in minimising his memory work, that the following tabular statement has been prepared.

Body.	Preparation.	Illustrations.
Metal.	Reduction of—	
	(*a*) Sulphide by heat	As, Sb (by help of Fe), Cu, Hg, and Pb.
	(*b*) Oxide with carbon	Cu, Zn, Sn, Fe, Mn, and Bi.
	(*c*) Chloride	Au (with $FeSO_4$), Be (Na), Mg (Na), Al (Na), Cr (Zn), Co, and Ni (H).
	Electrolysis (hydrate)	Na and K.
	Electrolysis (chloride, fused)	Mg, Be, Ca, Sr, Li, Ba?
Oxides.	Synthesis	As_2O_3, Bi_2O_3, ZnO, CdO, SnO_2.
	Reduction of—	
	Carbonate	SrO, CuO, CdO, PbO, MgO, Fe_3O_4. CaO.
	Nitrate	BaO, SrO, CdO, HgO, MnO_2, Co_2O_3, Ni_2O_3.
	Oxalate	SnO, Pb_2O.
Chlorides.	Synthesis	$AsCl_3$, $SbCl_2$, $BiCl_3$, $ZnCl_2$, Al_2Cl_6.
	Oxide or carb. + HCl	$CrCl_3$, $CuCl_2$, $CaCl_2$, $SrCl_2$, $PbCl_2$, $BaCl_2$, $MnCl_2$, $CoCl_2$, $NiCl_2$.
	Metal + aqua regia	$AuCl_3$, $PtCl_4$, Fe_2Cl_6.
	Metal + $HgCl_2$	$AsCl_3$, $BiCl_3$, $ZnCl_2$, Hg_2Cl_2, $SnCl_2$, $SnCl_4$.
Sulphates.	Native	K_2SO_4, Na_2SO_4, $MgSO_4$, $CaSO_4$, $SrSO_4$, $BaSO_4$, $Al_2(SO_4)_3$.
	Metal + H_2SO_4	$Sb_2(SO_4)_3$, $CdSO_4$, $SnSO_4$.
	Oxide + H_2SO_4	$Bi_2(SO_4)_3$, Ag_2SO_4, $MnSO_4$, $Cr_2(SO_4)_3$.
	Sulphide + air	$CuSO_4$, $FeSO_4$, $ZnSO_4$, $PbSO_4$.
Nitrates.	Metal or oxide + HNO_3	All except Au and Pt. For Sn the HNO_3 must be concentrated (S.G., 1·5).
	Native	KNO_3, $NaNO_3$.

Refractivities of the Inert Gases.—Writing to *Nature*, Mr. Clive Cuthbertson calls attention to the fact that there appears to exist between the refractivities of inert gases a simple relation which has hitherto escaped attention. Taking the refractivity of hydrogen as 1, the refractivities of the other gases are very nearly in the proportion of ¼, ½, 2, 3, and 5. The largest divergence is met with in helium, but this may be due to the fact that pure helium is practically unattainable. The following table gives the relations referred to:—

Refractivities Observed. Air = 1.	Ratio to H.	Calculated from H = 0·4733.	Error per cent.
Helium ..... 0·1238	¼	0·1183	− 4·4
Neon ..... 0·2345	½	0·2366	+ 0·9
Hydrogen ..... 0·4733	1	...	...
Argon ..... 0·968	2	0·9466	− 2·2
Kryptin ..... 1·450	3	1·420	− 2·0
Xenon ..... 2·364	5	2·367	+ 0·1

Fixation of Atmospheric Nitrogen.—Some further particulars of the apparatus used by the inventors, Messrs. Bradley and Lovign, are given in the *New York Electrical World and Engineer*. A cylindrical metal box is provided on its inner surface with six upright rows of fixed contacts, there being twenty-three contacts in each row. Each contact is connected through an inductance to the positive pole of a dynamo generating direct current at a pressure of 10,000 volts. A similar set of contacts is mounted on an inner rotating cylinder connected to the negative pole of the generator. As the inner cylinder rotates, the negative contacts come up to the positive, and an arc strikes across; this is gradually drawn out and finally extinguished as the negative contact moves past, and away from the positive. The action may be likened to the rotation of the cylinder in a musical box. Air circulates through the arcs, and is drawn off, containing about 2½ per cent. of oxide of nitrogen, and led to absorbing towers.

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ELECTRICITY AND MAGNETISM.

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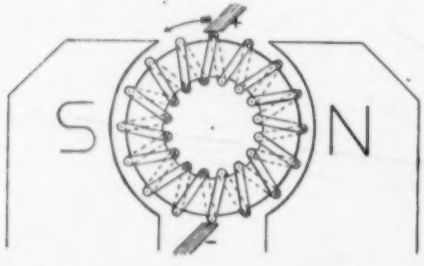
Speed of Motors.—When an electric current flows through the armature circuit of a motor, those parts of the circuit which lie in the air gap between the pole faces and the armature core are acted on by forces tending to set the armature in rotation. The turning moment, or torque, of the armature, is equal to the sum of the moments, about the axis of rotation, of the forces exerted on the various conductors; the magnitude of the torque is equal to $\frac{C l B r N}{10}$, measured in dyne-centimetres,

where C = total armature current—that is, current, in ampères, entering at the + brush and leaving at the − brush; l = length of each active wire—that is, of the portion of each turn which lies in the air gap; B = magnetic field in the air gap, in C.G.S. lines per sq. cm.; r = radius of circle swept out by each active wire; N = total number of active wires under one pole face.

Let us now suppose that the rotation of the armature is not resisted by any forces. According to this supposition, there must be no frictional forces at the brushes or bearings, and no machinery must be geared to the motor. As a matter of fact, there will always be an appreciable frictional force resisting the rotation of the shaft in the bearings, and there will also be a certain frictional force at the brushes; but these forces, in a well-constructed machine, will be small, and may be neglected for the present. In these circumstances, the effect of the torque is merely to increase the speed of rotation of the armature, the energy of the electric current being absorbed in increasing the kinetic energy of rotation of the armature. If the current in the armature circuit remained constant, the torque would be constant, and the rate of rotation (or speed) of the armature would increase by the same amount in each succeeding second, with the result that, after a comparatively short time, the speed of the armature would become indefinitely great. This result is contrary to experience. It is found that, with field magnets of a definite strength, if a certain definite potential difference is maintained between the brushes, the speed of the armature soon reaches a limiting value, *and thenceforth no appreciable current flows through the armature.* This result must be now explained.



Let diagram represent the armature, rotating in an anti-clockwise direction between the magnet poles N and S. The current enters the armature at the upper (+) brush, and leaves it at the lower (−) brush. On entering the armature, the current divides itself into two equal portions—one flowing down the armature coils on the right-hand side of the figure, the other flowing down the coils on the left-hand side of the figure. The direction of the current is indicated in the manner previously explained: a cross (×) drawn across the section of a conductor indicates that the current flows along it *from front to back* of the diagram, while a dot (.) indicates that the current flows *from back to front* of the diagram.

Now, each conductor moving in the air gap under a pole face is cutting lines of force, and as already explained, this will result in the generation of an electro-motive force. The conductors in the air gap under the N pole face will generate an E.M.F. acting from back to front of the figure: this result is easily deduced from the law explained in a preceding article. For similar reasons, the conductors under the S pole face generate an E.M.F. acting from front to back of the figure. In both cases the E.M.F. generated opposes the current, and consequently diminishes the strength of the latter. It is termed the *back* E.M.F. of the motor.

The numerical value of the back E.M.F. is easily obtained. When the armature is rotating at the rate of n turns per minute, the linear velocity, v, of one of the active wires is equal to $\frac{2\pi n}{60} r$ cms. per sec.

The E.M.F. generated by one wire is equal to Blv, and that generated by the N wires in series under one of the pole faces is equal to $NBlv$, or $\frac{2\pi n r l N B}{60}$ C.G.S. units.

To find the back E.M.F. in volts, we must divide the above value by 10^8. Thus the back E.M.F. is directly proportional to n.

It is now easy to trace the course of events ending in the attainment of a constant speed of rotation. So long as a current flows through the armature circuit, a torque will be exerted, which tends to increase n, the rate of rotation per minute. But as n increases, the back E.M.F. increases, with the consequence that the current, and with it the torque, diminishes. The current will be reduced to zero when the back E.M.F. is numerically equal to the direct E.M.F. maintained between the brushes. At this point the speed of the motor becomes constant, since, by supposition, there are no resisting forces to decrease its speed, and the absence of torque prevents any increase of speed. Under the conditions imagined, the armature would now continue to rotate at a constant speed for an indefinite time, since no supply of energy is requisite, there being no resisting forces against which work must be done.

In actual practice these conditions are never exactly fulfilled, owing to unavoidable friction at the bearings, brushes, etc. In this case the current will decrease in value till it just supplies the torque necessary to keep the armature in rotation against the resisting forces. When the motor is not geared to machinery, this current is generally very small; so that, when a motor is "running light," the conditions discussed above are complied with to a close approximation.

Problem.—A motor is run on a 100-volt circuit, the details of the motor winding, etc., being as follows:—

N = 100,
l = 10 cms.,
r = 20 cms.,
B = 7,000 lines per sq. cm.

1. What will be the speed of the motor when running light? 2. What will be the speed when the resisting forces may just be overcome by a torque of 5×10^8 dyne-cms., the armature resistance from brush to brush being 0·1 ohm? 3. What will be the rate of supply of energy in case (2)?

1. The constant speed will be attained when the back E.M.F. of the motor amounts to 100 volts. Thus—

$$\frac{2\pi n r l N B}{60 \times 10^8} = 100.$$

$$\therefore n = \frac{100 \times 60 \times 10^8}{2 \times 3{\cdot}14 \times 20 \times 10 \times 100 \times 7000}$$

$$= 682 \text{ turns per min.}$$

2. For the torque to be equal to 5×10^8 dyne-cms., the total current C (in ampères) must satisfy the equation

$$\frac{C l B r N}{10} = 5 \times 10^8.$$

$$\therefore C = \frac{5 \times 10^8 \times 10}{10 \times 7000 \times 20 \times 100}$$

$$= 35{\cdot}7 \text{ ampères.}$$

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Rough Inclined Plane.—It is obvious that all surfaces with which we are acquainted are more or less rough. The force necessary to move one body over another is found to be proportional to the force with which the two surfaces are pressed together. The simplest case is that of a weight W resting on a horizontal plane. Then, if F denotes the horizontal force necessary to cause motion, it is found in all cases that F is proportional to W. Hence $F = \mu W$, where μ is a constant, called the *coefficient of friction*, for the two surfaces in contact. For all values of F less than μW the body remains at rest, but motion takes place when F is greater than μW.

When a body of weight W or mass M rests on a plane inclined at an angle θ to the horizon, the normal component or pressure on the plane is $W \cos \theta$, and the force F necessary to move a body up the plane must be $W \sin \theta$ together with the frictional force $\mu W \cos \theta$.

$$\therefore F = W(\sin \theta + \mu \cos \theta).$$

If motion occurs *down* the plane, the frictional force will act up the plane, and the preceding equation becomes

$$F = W(\sin \theta - \mu \cos \theta).$$

As $F = Ma$, and $W = Mg$, we can write the preceding equation in the form

$$Ma = Mg(\sin \theta - \mu \cos \theta),$$

or,

$$a = g(\sin \theta - \mu \cos \theta).$$

The acceleration is positive so long as $\mu \cos \theta$ is greater than $\sin \theta$ and is negative—that is, retardation takes place when $\mu \cos \theta$ is greater than $\sin \theta$.

Ex. 1. A particle is projected directly up a smooth inclined plane; find the height to which it will rise, and prove that it will arrive again at the point of projection with its initial velocity. (1898.)

The velocity of the particle, when it has described a distance s from the starting-point, may be obtained from the equation $v^2 = V^2 - 2gs \sin \theta$, where V denotes the initial velocity.

At the instant that the particle reaches its maximum distance from the starting-point and begins to return, its velocity v will be zero. Hence $V^2 = 2gs \sin \theta$.

But if h is the vertical height moved through, $\sin \theta = \frac{h}{s}$. Substituting this value, we find

$$V^2 = 2gs \times \frac{h}{s} = 2gh. \quad \therefore V = \sqrt{2gh}.$$

The velocity V′ of the particle when it reaches the starting-point will be that due to a height h, or $V' = V$.

The preceding result may be generalised. Thus, if a particle slides from rest down any smooth curve or surface under the action of its own weight, the velocity acquired from any point A to another B is $\sqrt{2gh}$, where h is the difference of level between A and B.

Although no such thing as an absolutely smooth curve exists, a particle may be made to move down an assigned curve without friction. Thus, a particle P may be made to move in a circle about a point of suspension, and is known as a *conical pendulum*. Another familiar example is the so-called simple pendulum.

Simple Pendulum.—A small particle P attached to one end of a fine flexible string, the other end of which is fixed to a point O, constitutes what is called a simple pendulum. Let ON be the vertical line through O; then, when OP is displaced through a small angle θ, there is a force mg tending to bring P to its position of rest at N. Resolving mg along and perpendicular to the string, then the first component produces a tension in the string; the latter, $mg \sin \theta$, is the component producing motion.

Fig. 3.

From the relation $a = \frac{\text{force}}{\text{mass}} = \frac{mg \sin \theta}{m}$, we find $a = g \sin \theta$. We may assume, for the present, the well-known law in *simple harmonic motion*—that is, *Acceleration divided by displacement equals a constant.* The displacement is the circular arc NP, and if l denotes the length of OP, then $NP = l\theta$ (from the relation, length of arc ÷ by radius is the angle in circular measure subtended by the arc).

$$\therefore \frac{\text{acceleration}}{\text{displacement}} = \frac{g \sin \theta}{l\theta}.$$

When the displacement is small, $\sin \theta$ is very approximately equal to θ. Hence we may substitute, and write the equation

$$\frac{2^2\pi^2}{t^2} = \frac{g}{l}.$$

$$\therefore t = 2\pi\sqrt{\frac{l}{g}},$$

where t is the periodic time in seconds. The time of a swing or semi-oscillation is half the preceding.

$$\therefore t = \pi\sqrt{\frac{l}{g}}.$$

The length of a seconds pendulum can be found by putting $t = 1$, and the preceding formula becomes

$$1 = \pi\frac{2l}{g}.$$

$$\therefore l = \frac{g}{\pi^2}.$$

This gives about 39·1 in. for l when g is 32·2 ft. per sec. per sec.

Ex. 2. A pendulum 105 cms. long beats seconds at a certain place on the earth. Find how long it will take a body to fall 100 feet at the same place, neglecting the resistance of the air. Take 1 cm. = ·0328 ft., and $\pi^2 = 9{\cdot}87$. (1902.)

To find how long it will take a body to fall 100 feet, we must find the value of g at the place.

$$t = \pi\sqrt{\frac{l}{g}}.$$

$$\therefore 1 = \frac{\pi^2 \times l}{g}.$$

$$\therefore g = \pi^2 \times l = 9{\cdot}87 \times 105 \times {\cdot}0328,$$

or,

$$g = 33{\cdot}99 \text{ ft. per sec. per sec.},$$

$$s = \tfrac{1}{2}gt^2.$$

$$\therefore 100 = \tfrac{1}{2} \times 33{\cdot}99 \times t^2,$$

or,

$$200 = 33{\cdot}99t^2.$$

$$\therefore t = \sqrt{\frac{200}{33{\cdot}99}} = 2{\cdot}425 \text{ sec.}$$

Ex. 3. State the relation between the mass of a body and the acceleration of its velocity due to a given force.

Illustrate the statement by finding the acceleration of the velocity of a body which slides down a rough inclined plane. (1902.)

Ex. 4. Enunciate the laws of friction, and give examples of limiting friction and of friction which is not limiting.

A heavy particle is on a rough horizontal plane; if the plane be moved horizontally, with acceleration f, show that the particle will not move relatively to the plane if f be not greater than μg, where μ is the coefficient of friction. (1901.)

Ex. 5. If the point of suspension of a simple pendulum be moved horizontally with an acceleration of 4 feet per sec. per sec., what is the position of relative equilibrium? (1902.)

Ex. 6. A body is projected at an angle α to the horizontal, and with the velocity due to the height h; show that at every instant the vertical height of the body and its horizontal distance from the point of projection are connected by an invariable relation.

If α be variable, show that the greatest possible range on the line of greatest slope of a plane inclined at an angle β to the horizon, when the projection takes place in the vertical plane containing that line, is $2h \div (1 + \sin \beta)$. (1899.)

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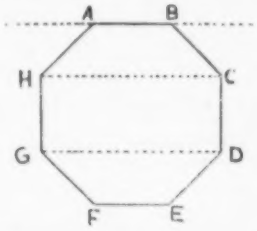
Esk.—Find the centre of pressure of a regular octagon immersed in water with one edge in the surface.



Let ABCDEFGH be the given octagon, having one of its edges, AB, in the surface of the liquid.

The integration may be conveniently divided into three parts—that is, the portions ABCH, CDGH, and DEFG.

Hence, if x denotes the distance of an elementary strip from the surface, we have—

$$\int (a + 2x)dx \,.\, x^2 + \int (a + \sqrt{2}a)dx + x^2$$

$$+ \int \left[a + \sqrt{2}a - 2\left(x - a - \frac{\sqrt{2}a^2}{a}\right)\right] dx \,.\, x^2 = \bar{z} \times A \times \bar{x},$$

where $\bar{z}$ denotes the depth of the centre of area from the edge AB. A denotes the area of the octagon, and $\bar{x}$ is the depth of the centre of pressure. The three indefinite integrals on the left-hand side in order are—

$$\frac{ax^3}{3} + \frac{2x^4}{4},\ (a + \sqrt{2}a)\frac{x^3}{3},\ \text{and}\ (3 + 2\sqrt{2})\frac{ax^3}{2}.$$

These must be taken between the limits,

0 and $\frac{a\sqrt{2}}{2}$; $\frac{a\sqrt{2}}{2}$ and $a + \frac{a\sqrt{2}}{2}$; $a + a\sqrt{2}$ and $\frac{a + a\sqrt{2}}{2}$

respectively; putting in these limits, the left-hand side of the equation becomes, on simplification—

$$\frac{a^4}{48}(4\sqrt{2} + 6 + 88 + 64\sqrt{2} + 424 + 300\sqrt{2} - 306 - 216\sqrt{2}).$$

$$= \frac{a^4}{48}(152\sqrt{2} + 212).$$

Also $$\bar{z} = \left(\frac{a}{2} + \frac{a\sqrt{2}}{2}\right),$$

and $$A = (a + a\sqrt{2})^2 - a^2 = 2a^2(\sqrt{2} + 1).$$

Hence the right-hand side of the equation becomes—

$$\left(\frac{a}{2} + \frac{a\sqrt{2}}{2}\right)[2a^2(\sqrt{2} + 1)]\bar{x}$$

$$= a^3\left[\frac{(1 + \sqrt{2})(2\sqrt{2} + 2)}{2}\right]\bar{x}.$$

$$\therefore\ \bar{x}\left[\frac{(1 + \sqrt{2})(2\sqrt{2} + 2)}{2}\right]a^3 = \frac{a^4}{48}(152\sqrt{2} + 212);$$

or, $$\bar{x} = \frac{a(152\sqrt{2} + 212)}{48(3 + 2\sqrt{2})}.$$

The centre of pressure of a given area may be obtained by using the formula $\bar{x} = \frac{I}{\bar{Z}A}$, where $\bar{Z}$, A, and $\bar{x}$ have the same meaning as before, and I is the moment of inertia of the given area about an edge AB; hence, substituting the values, the required result may be found.

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C.E.S.—Volcanic cones vary considerably in structure and materials. In some cases the cone is composed almost entirely of cinders, in which case the materials are piled in regular layers around the central opening or neck of the volcano, and are so arranged that the different strata rise upwards at first as they are followed from the pipe, and then dip downwards and gradually thin out as the distance from the pipe increases. This arrangement, of course, leaves a fairly wide opening, called the crater, at the top of the cone. Such simple cones, however, are comparatively rare. Sometimes cones are formed by viscid lava pouring from the volcano and welling up into a dome shape, as in the case of the steep-sided domes of Bourbon and Bohemia. The slope of these cones, however, depends on the viscosity of the ejected liquid. If the liquid is very mobile, then the cone may be very depressed and flat, as in the case of the Hawaii volcanoes, which have a slope of 4° only. Generally, the cones are built up of alternate but irregular layers of lava and of broken materials, and are then spoken of as compound cones.

The fragmentary portions consist of:—(1) *Volcanic ash*, formed by the attrition in the air of the blocks of rock thrown from the neck of the volcano. (2) *Lapilli*, or the small rounded fragments which have not been reduced to so fine a state of division as the dust. (3) *Tuff*, which is formed by the cementing together of some of the fragmentary material ejected. (4) *Scoriæ*, composed of portions of rock which have been distended by gas while in a semi-molten condition, and are consequently rough like a cinder. (5) *Volcanic bombs*, which are really fusiform masses of lava (sometimes distended by gas) which have assumed a somewhat globular shape during their rotation in the air. (6) *Lava*, which usually pours in streams from the volcano, and afterwards solidifies to solid rock with a scoriaceous exterior.

When a volcano becomes denuded, it is often possible from an examination of the denuded cone to make out its structure; but in some cases we are actually able to examine a section of a volcano where a portion of the volcano has been removed by the action of water (river or sea), as in the case of some of the cones in the central portions of France, and at Castletown in the Isle of Man.

C.F.—Find the value of

$$\int_0^\infty \frac{\sin a\theta \, d\theta}{e^{\pi\theta} - e^{-\pi\theta}}.$$

(Williamson's *Integral Calculus*, p. 154, No. 7.)

To evaluate this integral, first notice that—

$$\sin a\theta = \frac{e^{ia\theta} - e^{-ia\theta}}{2i},$$

where $i = \sqrt{-1}$. By substituting $a = ia$, the above integral can be made to depend on

$$\int_0^\infty \frac{e^{a\theta} - e^{-a\theta}}{e^{\pi\theta} - e^{-\pi\theta}} d\theta,$$

which, in its turn, can be decomposed into the two integrals

$$\int_0^\infty \frac{e^{a\theta} d\theta}{e^{\pi\theta} - e^{-\pi\theta}} - \int_0^\infty \frac{e^{-a\theta} d\theta}{e^{\pi\theta} - e^{-\pi\theta}}.$$

In the first of these integrals, let $e^{\pi\theta} = x$. Then $\pi e^{\pi\theta} d\theta = dx$.

$$\therefore d\theta = \frac{dx}{\pi x}.$$

Further, $e^{a\theta} = (e^{\pi\theta})^{\frac{a}{\pi}} = x^{\frac{a}{\pi}}$.

When $\theta = 0$, $x = 1$; when $\theta = \infty$, $x = \infty$. Thus

$$\int_0^\infty \frac{e^{a\theta} d\theta}{e^{\pi\theta} - e^{-\pi\theta}} = \frac{1}{\pi} \int_1^\infty \frac{x^{\frac{a}{\pi}}}{x^2 - 1} dx.$$

In the second integral, let $e^{-\pi\theta} = x$. Then $-\pi e^{-\pi\theta} d\theta = dx$.

$$\therefore d\theta = -\frac{dx}{\pi x}.$$

Further, $e^{-a\theta} = (e^{-\pi\theta})^{\frac{a}{\pi}} = x^{\frac{a}{\pi}}$.

When $\theta = 0$, $x = 1$; when $\theta = \infty$, $x = 0$. Thus

$$\int_0^\infty \frac{e^{-a\theta} d\theta}{e^{\pi\theta} - e^{-\pi\theta}} = -\frac{1}{\pi} \int_1^0 \frac{x^{\frac{a}{\pi}} dx}{1 - x^2} = -\frac{1}{\pi} \int_0^1 \frac{x^{\frac{a}{\pi}} dx}{x^2 - 1}.$$

$$\therefore \int_0^\infty \frac{e^{a\theta} - e^{-a\theta}}{e^{\pi\theta} - e^{-\pi\theta}} d\theta = \frac{1}{\pi} \left\{ \int_1^\infty \frac{x^{\frac{a}{\pi}} dx}{x^2 - 1} + \int_0^1 \frac{x^{\frac{a}{\pi}} dx}{x^2 - 1} \right\}$$

$$= \frac{1}{\pi} \int_0^\infty \frac{x^{\frac{a}{2\pi}} dx}{x^2 - 1}.$$

Next, let $x^2 = z$. Then $2x dx = dz$, and $dx = \frac{1}{2} z^{-\frac{1}{2}} dz$.

$$\therefore \frac{1}{\pi} \int_0^\infty \frac{x^{\frac{a}{2\pi}} dx}{x^2 - 1} = \frac{1}{2\pi} \int_0^\infty \frac{z^{\left(\frac{a+\pi}{2\pi} - 1\right)} dz}{z - 1}.$$

Now,
$$\int_0^\infty \frac{x^{b-1} dx}{x - 1} = -\pi \cot b\pi, \quad \ldots \quad (1)$$

subject to the condition that $b < 1$. This result will be proved subsequently, but may be assumed for the present. Then, if $\left(\frac{a+\pi}{2\pi}\right) < 1$, that is, if $a < \pi$,

$$\frac{1}{2\pi} \int_0^\infty \frac{z^{\left(\frac{a+\pi}{2\pi} - 1\right)} dz}{z - 1} = -\frac{\pi}{2\pi} \cot\left(\frac{a+\pi}{2\pi} \cdot \pi\right) = \frac{1}{2} \tan \frac{a}{2}$$

$$= \frac{1}{2} \frac{\frac{ia}{e^2} - e^{-\frac{ia}{2}}}{\frac{2i}{ia} + e^{-\frac{ia}{2}}}.$$

Returning now to the original integral, we have, on substituting $a = ia$—

$$\int_0^\infty \frac{\sin a\theta}{e^{\pi\theta} - e^{-\pi\theta}} d\theta = \frac{1}{2i} \int \frac{e^{ia\theta} - e^{-ia\theta}}{e^{\pi\theta} - e^{-\pi\theta}} d\theta = \frac{1}{4i} \frac{\frac{ia}{e^2} - e^{-\frac{ia}{2}}}{\frac{2i}{ia} + e^{-\frac{ia}{2}}}$$

$$= -\frac{1}{4} \frac{e^{-\frac{a}{2}} - e^{+\frac{a}{2}}}{e^{-\frac{a}{2}} + e^{-\frac{a}{2}}} = \frac{1}{4} \frac{e^a - 1}{e^a + 1},$$

which is the required result.

Equation (1) can be derived from the solution of the standard definite integral—

$$\int_0^\infty \frac{x^{2n}}{1 - x^{2n}} = \frac{\pi}{2n} \cot \frac{2m+1}{2n} \pi \quad \ldots \quad (2)$$

In (2), let $x^{2n} = z$. Then $dx = \frac{1}{2n} x^{-\frac{1}{2}} dz$.

$$x^{2m} = z^{\frac{m}{n}}.$$

$$\therefore \int_0^\infty \frac{x^{2m}}{1 - x^{2n}} = \frac{1}{2n} \int_0^\infty \frac{z^{\left(\frac{m}{n} - \frac{1}{2}\right)} dz}{1 - z} = \frac{1}{2n} \int_0^\infty \frac{z^{\left(\frac{2m+1}{2n} - 1\right)} dz}{1 - z}$$

$$= \frac{\pi}{2n} \cot \frac{2m+1}{2n} \pi.$$

Thus, if $b = \frac{2m+1}{2n}$, so that $b < 1$

$$\int_0^\infty \frac{z^{b-1}}{1 - z} = \pi \cot b\pi.$$

If you require assistance to solve (2), please write again.

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Fragelig.—Find z from the equations—

$$x^2 = a^2 + b^2 - ab.$$
$$y^2 = b^2 + z^2 - bz.$$
$$(x + y)^2 = a^2 + z^2 + az.$$

(S. K. Mathematics, Stage 3, 1897.)

Adding the sum of the first two equations to twice the square root of their product, we obtain the relation

$$x^2 + 2xy + y^2 = a^2 + 2b^2 - ab + z^2 - bz$$
$$+ 2\sqrt{(a^2 + b^2 - ab)(b^2 + z^2 - bz)}.$$

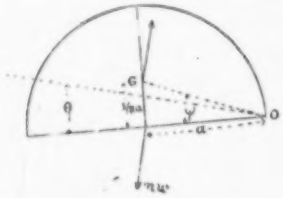
But $x^2 + 2xy + y^2 = a^2 + z^2 + az$.

$$\therefore 2b^2 - ab - (a + b)z + 2\sqrt{(a^2 + b^2 - ab)(b^2 + z^2 - bz)} = 0.$$
$$\therefore 2\sqrt{(a^2 + b^2 - ab)(b^2 + z^2 - bz)} = (a + b)z + b(a - 2b).$$
$$\therefore 4(a^2 + b^2 - ab)(b^2 + z^2 - bz) = \{(a + b)z + b(a - 2b)\}^2.$$
$$\therefore \{4(a^2 + b^2 - ab) - (a + b)^2\}z^2$$
$$- b\{4(a^2 + b^2 - ab) + 2(a + b)(a - 2b)\}z$$
$$+ b^2\{4(a^2 + b^2 - ab) - (a - 2b)^2\} = 0.$$
$$\therefore 3(a - b)^2z^2 - 6ab(a - b)z + 3a^2b^2 = 0.$$
$$\therefore (a - b)^2z^2 - 2ab(a - b)z + a^2b^2 = 0.$$
$$\therefore \{(a - b)z - ab\}^2 = 0.$$
$$\therefore z = \frac{ab}{a - b}.$$

Arnus.—A hemisphere of weight w, and specific gravity σ, fixed at a point on its rim, is loaded at another point, at the distance of a quadrant measured along the rim from the former, with a weight nw, and the whole is completely immersed in liquid. Find the inclination of the plane of the base to the horizon.

Ans. $\text{Tan}^{-1}\left[\frac{8}{3}\sqrt{1 - 2n\lambda + 2n^2\lambda^2}\right]$, where $\lambda = \frac{\sigma}{1 - \sigma}$.

The plane of the paper may be taken to be the plane containing diameter of base through o, where o is the fixed



point. Taking moments about a horizontal axis through o, and perpendicular to plane of paper,

then $nwa\cos\theta = \frac{w}{\lambda}\cos(\psi - \theta)\,a\sqrt{1 + \left(\frac{3}{8}\right)^2}$ . . (1),

where $\sin\psi = \frac{\frac{3}{8}}{\sqrt{1 + \left(\frac{3}{8}\right)^2}}$, and $\cos\psi = \frac{1}{\sqrt{1 + \left(\frac{3}{8}\right)^2}}$.

$$\therefore n\lambda\cos\theta = \sqrt{1 + \left(\frac{3}{8}\right)^2}\cos(\psi - \theta)$$
$$= \sqrt{1 + \left(\frac{3}{8}\right)^2}(\cos\theta\cos\psi + \sin\theta\sin\psi)$$
$$= \cos\theta + \frac{3}{8}\sin\theta.$$
$$\therefore (n\lambda - 1)\cos\theta = \frac{3}{8}\sin\theta,$$
$$\text{or } \tan\theta = \frac{8}{3}(n\lambda - 1) \quad . . . . . (2).$$

Take moments about a horizontal axis in plane of paper. Let ϕ be the angle between the axes of symmetry of the hemisphere and the vertical as seen by projection on a plane through o perpendicular to the axis considered.

Then $nwa\cos\phi = \frac{w}{\lambda} \times \frac{3}{8}a\sin\phi$,

$$\text{or } \tan\phi = \frac{8}{3}n\lambda.$$

But θ and ϕ are the inclinations of lines whose planes are at right angles. In this case, $\tan^2\theta + \tan^2\phi = \tan^2\beta$, where β is the inclination of the planes.

$$\therefore \left\{\frac{8}{3}(n\lambda - 1)\right\}^2 + \left(\frac{8}{3}n\lambda\right)^2 = \left(\frac{8}{3}\right)^2(1 - 2n\lambda + 2n^2\lambda^2).$$

Hence $\beta = \tan^{-1}\left[\frac{8}{3}\sqrt{1 - 2n\lambda + 2n^2\lambda^2}\right]$.

R.J.P.—See answer to *Omega* in the November number of this journal, page 262.

Kenneth.—You will be able to get the Hebrew Bible at the British and Foreign Bible Society, Queen Victoria Street, London. For annotated editions you had better apply to the Oxford University Press, Amen Corner, London, E.C.

J.C., P.T. Centre.—(*a*) There is no text-book for Honours Physiography, excepting that of Gregory (Nelson's), which of necessity only covers a part of the ground.

(*b*) We know of no edition of Honours Physiography questions except those published by the Board of Education, South Kensington.

(*c*) There is no guide published, to our knowledge, to this examination.

H. D. Stanley.—Solve the following equations :—

$$\left.\begin{aligned}\frac{xy}{x + y} &= 1.\\ \frac{xz}{x + z} &= 2.\\ \frac{yz}{y + z} &= 3.\end{aligned}\right\}$$ (Wrigley's *Examples.*)

From the first of the given equations we have—

$$xy = x + y. \quad \therefore y(x - 1) = x.$$
$$\therefore y = \frac{x}{x - 1}. \quad . . . . . (1)$$

Again, from the second of the given equations we have—

$$xz = 2x + 2z. \quad \therefore z(x - 2) = 2x.$$
$$\therefore z = \frac{2x}{x - 2}. \quad . . . . . (2)$$

Writing in the third of the given equations the values of y and z obtained in (1) and (2), we have $yz = 3(y + z)$.

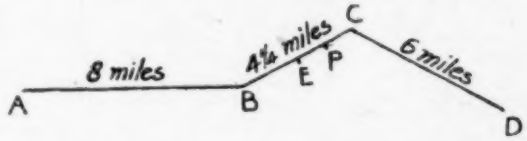
$$\therefore \frac{x}{x - 1}\cdot\frac{2x}{x - 2} = 3\left(\frac{x}{x - 1} + \frac{2x}{x - 2}\right) = 3x\left(\frac{1}{x - 1} + \frac{2}{x - 2}\right).$$
$$\therefore 2x^2 = 3x(x - 2 + 2x - 2). \quad \therefore 2x^2 = 9x^2 - 12x.$$
$$\therefore 7x^2 = 12x. \quad \text{Hence } x = 0, \text{ or } 1\tfrac{5}{7}.$$

Then from (1), $y = 0$, or $1\frac{2}{3}$; and from (2), $z = 0$, or -12.

Hence the values of x, y, and z which satisfy the given equations are $x = 1\frac{5}{7}$, $y = 1\frac{2}{3}$, $z = -12$.

Scotty.—Two pedestrians, x and y, start on a journey from A and D respectively, their rates being as 4 : 3. x's rate on the level is 4 miles, uphill 3 miles and downhill 5 miles per hour. Where do they meet?

(Customs Exam. Papers, January 1902.)



y travels from D to C at the rate of $\frac{3}{4}$ of 3 miles per hour. Hence y takes $\frac{6}{\frac{3}{4}}$ hours (that is, 160 minutes) to reach the point C.

x reaches B in $\frac{2}{3}$ hours, or 120 minutes, and has, therefore, been walking uphill from B towards C for 40 minutes when y reaches C. Let E denote the point which x has then reached.

Since x goes uphill at 3 miles an hour, he will cover two miles in the 40 minutes. Hence the distance BE is 2 miles, and therefore EC = $2\frac{1}{2}$ miles. The question now is, at what point (P) in EC will x, travelling at 3 miles an hour, and y, travelling at $\frac{3}{4}$ of 5 miles an hour, meet?

Obviously we have EP : CP :: 3 : $\frac{3}{4}$ of 5.

$\therefore$ EP : CP :: 4 : 5.

Hence EP = $\frac{4}{5}$ of EC = $\frac{4}{5}$ of $2\frac{1}{2}$ = 1 mile.

$\therefore$ AB + BE + EP = 8 + 2 + 1 = 11 miles.

Therefore the place of meeting is 11 miles from A and $7\frac{1}{2}$ miles from D.

Replies to other correspondents have been sent by post.

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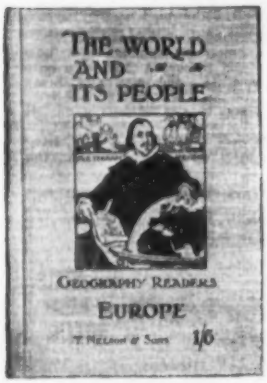

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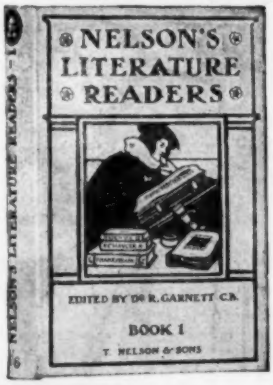

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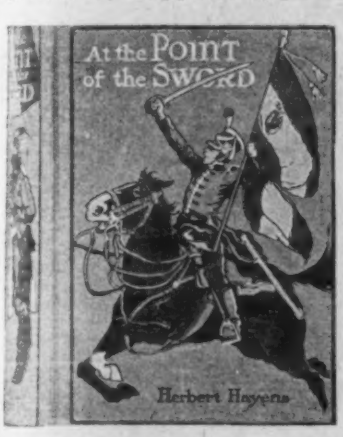

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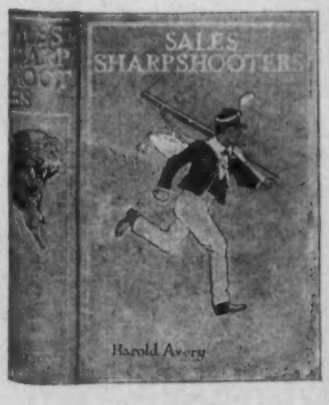

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